

The Journal
OF THE
Royal United Service Institution.

VOL. XXXVIII.

JUNE, 1894.

No. 196.

[Authors alone are responsible for the contents of their respective Papers.]

Friday, February 2, 1894.

REAR-ADMIRAL H. F. CLEVELAND in the Chair.

SOME ASPECTS OF COAST DEFENCE.

By Lieutenant-Colonel J. R. J. JOCELYN, R.A.

THE tactics of coast defence is a wide subject, involving much that an engineer or a sailor is more qualified to deal with than an artilleryman, so that I propose to confine myself to my own arm; but even with this restriction, time will not admit of anything like completeness of treatment, and I feel obliged to crave indulgence for a certain want of coherence and continuity that, doubtless, will be detected in my remarks. I would, however, plead in excuse, that coast defence is no longer an unfamiliar subject, in view of the many excellent lectures that have touched upon it in this theatre, during the last five years, and, in addition, that it is possible, I shall best employ the time at my disposal, in directing attention to certain points of interest or importance, at the present time.

The fighting units of coast artillery may be simply stated: the smallest is the group, which should be composed of two or more pieces, under the command of a group officer; an assemblage of two or more groups constitutes a fort, under a fort commander; while two or more forts, make up a section, under a section C.R.A. All the guns of a group should have the same field of fire, all the groups of a fort should command the same waterway, all the forts of a section should fire on the same line of approach. There are other officers, and other commands and modifications of commands, but this is practically the chain of responsibility, and the object of the organization is to bring every piece into action, with its proper ammunition, as soon as it can bear on an enemy, to keep it in action till all objectives are disabled or out of range, and to accomplish this end as quickly as possible.

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Certain subjects connected with this essentially artillery aspect of coast defence may be presented to you, as pegs whereon to hang discussion; they are as follows:—The selection of guns and mountings; the placing of guns; the control of guns; the choice of ammunition; the laying of guns; what we may expect from guns; the action of guns at night; requirements for training personnel. I do not propose taking them *seriatim*, but in such order as will most conduce to brevity and clearness.

I. *The Laying of Guns.*

In order to lay a gun correctly, the range and training which will cause the projectile to hit the objective must be known. Now no range or position finder in existence, is able to give us this information. Something else is necessary.

The Three Service Methods of Gun Laying.—There are three Service methods of gun laying, known as Cases I, II, and III, each of which, in turn, becomes suitable, as conditions change.

Case I.—The tangent scale is raised to the *proper height*, and the gun layer is responsible for line and elevation. The position finder (P.F.), or the depression range-finder (D.R.F.), can be employed to measure the distance of the object. The advantages of this method are, that it is independent of rise and fall of tide, and is more accurate than quadrant elevation; also from a high site, errors in range, are minimised by its use. The disadvantages are, that it depends greatly on the visibility of the object, and personal error is apt to creep in. As the gun layer is obliged to jump clear before the gun is fired, and as it is more difficult to keep on the object than when only laying for line, it is less rapid than Case II; it is unsuited to salvo fire, and is awkward at night, on account of the difficulty of seeing the graduations of the scale.

At present Q.F. guns have always to be fired by this method; it should be employed for all guns, when the range is not accurately known, or if instruments break down, or are out of adjustment.

Case II.—The *proper quadrant elevation* is given to the gun, under the superintendence of the gun captain, while the gun layer, standing on a sighting step, lays the gun for line by aid of straight-edged sights.

The P.F. or D.R.F. can be used to measure the distance of the object. The advantages of this method are, that the gun can often be laid correctly when the view of the object from the gun is much obscured; the division of labour, in laying, eliminates personal error, and tends to speed and accuracy; it is convenient for salvo fire and night work, the gun layer remaining on the step, when the gun is fired, and having no scales to alter. Its disadvantage is, that if the correct range is not known, the resulting error will be greater than with Case I. Case II is the normal method.

Case III.—The sights are not used, and the gun is laid by quadrant elevation and training arc, for what is called “predicted firing.” It is only possible with the P.F. This instrument can be made to pre-

dict the *proper range and training* at which to fire, before the time for firing arrives, this information being exhibited on group dials, which are in electric communication with the instrument. Quadrant elevation is given under the superintendence of the gun captain, while the gun layer sees that the mounting is traversed, until its pointer is at the proper position, over the graduated arc, on the gun floor. At the proper time, the gun is fired electrically. The advantages of this method are, that a gun can be fired at an object totally invisible to, or only seen with difficulty from, the gun floor, as long as it can be made out, by the telescope of the instrument. The invisibility may be due to smoke, haze, or the way the gun is mounted or placed; the partial invisibility, to long range or temporary meteorological conditions, such as a hail storm beating in the face of the gun layer. Its disadvantages are, that in general, guns shoot better and more rapidly when laid by aid of the sights, especially if there is any great "displacement" or distance between the instrument and the group it serves. There are other technical points that I need not touch on. This method would be used with advantage for direct long range salvo fire, and, at all times, when guns are specially mounted for high angle fire; occasionally it possesses advantages at night, and must always be resorted to, when laying by direct vision is impossible. It is, in every case, a valuable alternative to the other cases.

Now, in all three cases, the *proper range*, and in Case III the *proper training*, in addition, must be exhibited on the group dials. Either the P.F. or the D.R.F., when in proper adjustment, can measure with great accuracy the distance between an object and the pedestal on which the instrument is placed; the former can, in addition, determine the distance between the object and the pivot gun of the group; but more than this is required; the fort commander is obliged to apply certain "corrections" to the information, given by the instruments.

The Powder Correction.—Great strides have doubtless been made in the manufacture of powder, and, if only proper precautions are taken in sorting and weighing, very regular shooting may be looked for, on any given day, from any given batch of powder; but the strength may vary from time to time, and generally a correction has to be made, at any rate at first, until the guns get warm. We may, however, note in passing, that bad results are often ascribed to what is called "error of the day," which are really due to bad adjustment of instruments, defects in loading, and the like. The powder correction has to be considered, with all three cases, whether P.F. or D.R.F. is used.

Tide Correction.—Whereas tangent elevation is unaffected by height of site, quadrant elevation scales have to be made out for each fort; they are constructed, so as to be suitable for the height of the work, above mean tide; alterations in the level of the latter will sometimes cause serious alterations in range. The necessary allowance will increase with the difference from mean level, in the height of the tide, and the sharpness of the angle at which the shot strikes the

water. Other things being equal, low sites and short ranges increase the importance of this correction. It must always be considered in Case III, and also in Case II, whether P.F. or D.R.F. is used. It does not come in to Case I.

The Correction for Travel of Objective.—This correction must be considered in Cases I and II, whether P.F. or D.R.F. is made use of. We will take the case of the D.R.F. first. Before the group officer orders any range to be put on his guns, he must compensate it for the difference between the distances of the object from the instrument and the pivot gun, and this he does by applying a "group difference," previously laid down, which depends on the displacement and the way the gun is pointing (see Fig. 3). Having regard then, to the time, when it will be his duty to fire, and also to the way the range is changing, as shown on the group dials, he gives a certain range, corrected for difference, to his guns, and orders them to fire when the range itself appears on the group dial. But before this can take place, the following course is followed. The observer at the telescope, T (see Fig. 1), follows the object, while another man watches the range drum of the instrument, and calls out ranges, in such a way and at such intervals, as may have been ordered by the fort commander, and in obedience to these calls, a third individual moves a large dial, close to the instrument, known as the fort commander's dial. A fourth individual copies on the group dial, the movements of the fort commander's dial. When his selected range appears on the former, the group officer orders his group or gun to "commence firing." The gun layers see that their line is correct, and throw up their arms in Case II, or quickly finish their laying and jump down in Case I; at either of these signals, the gun captains involved, order their guns to fire, and the Nos. 4 pull the lanyards.

Next suppose the P.F. is finding the range. Almost the same procedure is followed, except that the group officers have not to correct for displacement. The observer at the P.F. telescope, T' (see Fig. 1), having manipulated the instrument as ordered by the fort commander, follows the object and the group dial exhibits ranges. These are called out, at intervals, by the dial readers, and when the selected range is heard, the group officer orders his group to commence firing, and gun layers, gun captains, and Nos. 4 proceed as above detailed. The P.F., thus, saves group difference and three of the operations, necessary in the former case.

The time taken up in this transmission of the range is called the "time of firing," and depends on the fort and the smartness of the men.

After the gun is fired the "time of flight" has to elapse before the shot strikes, and both during this period, and the "time of firing" the position of the object may alter, the necessary allowance depending on its speed and direction. This correction is not required with Case III.

In addition to these corrections for range, there are others that refer to training.

Training Corrections.—In Cases I and II, either with P.F. or



Fig. 2.

Clock Dial



Dial
Number

Group
Officer

P.F. Dial



Dial
Number

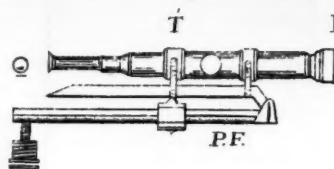
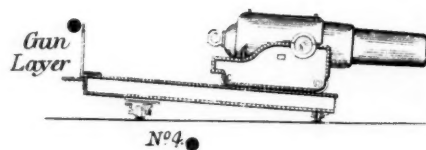
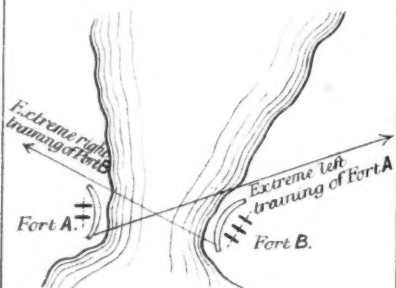


Fig. I.



Gun
Captain

Fig. 4.



Fort Commander's
Clock Dial



Dial
Number

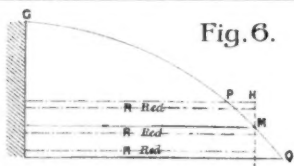
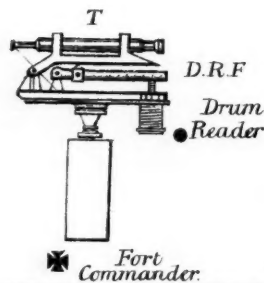
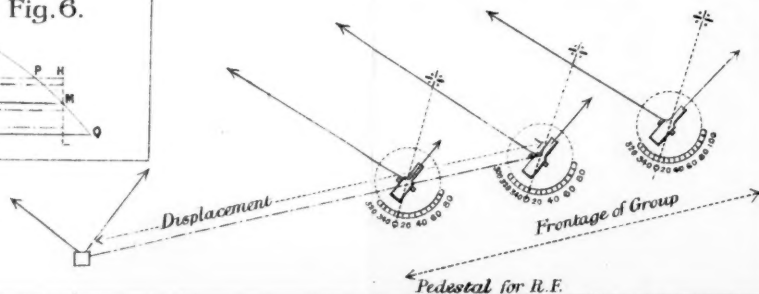


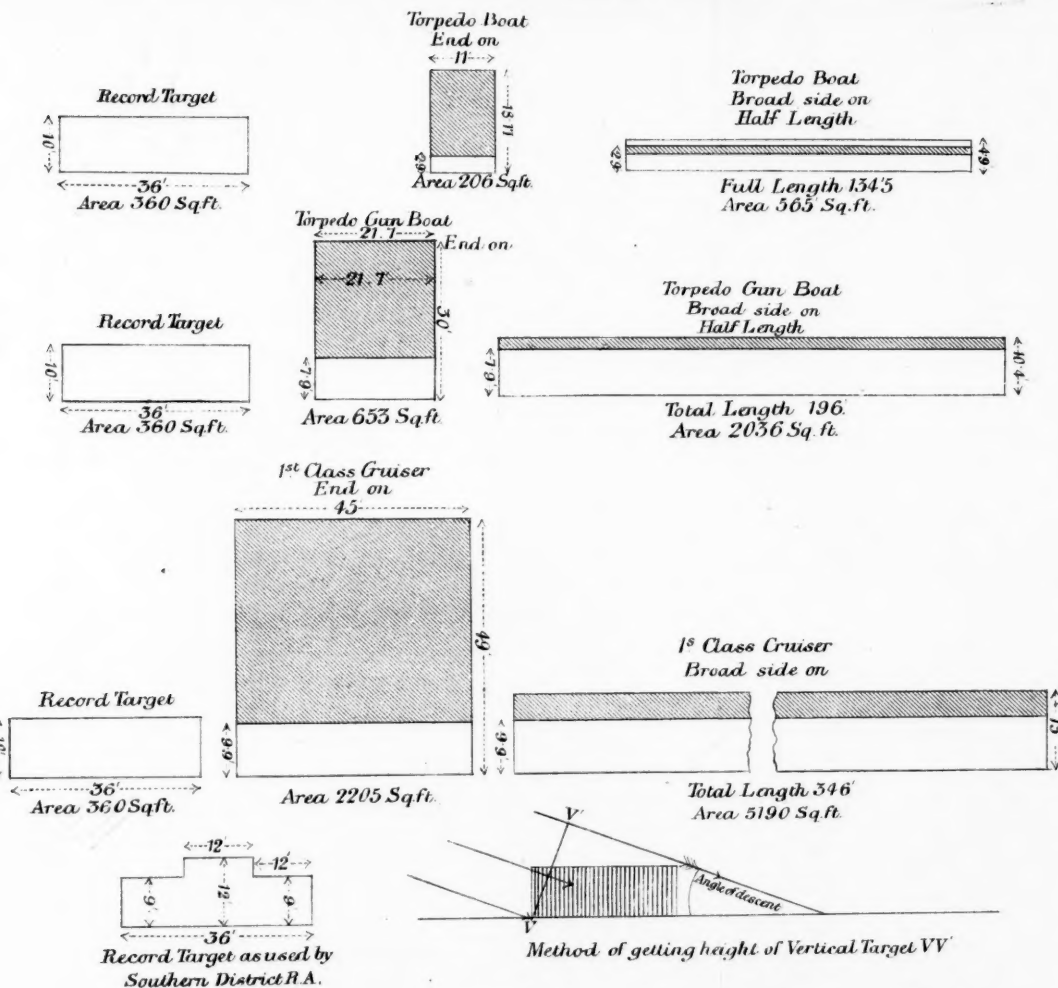
Fig. 6.

Fig. 3.



VERTICAL TARGETS.

Fig.5.


 Scale $\frac{1}{384}$

N.B.—Shaded portions represent decks.

	Free board.	Beam.	Length.
Torpedo Boat	3	11	134.5
Torpedo Gun Boat	8	21.7	196
First Class Cruiser	10	45	346

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D.R.F., these corrections are made by giving a certain amount of deflection on the leaf of the back sight. They are necessitated by the effect of wind and the angular travel of the object during the time of flight, in Case II, or the time made up of the latter and that taken by the gun layer to complete the laying, in Case I. In addition, if the bow or stern wave is made use of as a lay point, deflection may be necessary, to bring the projectile to a certain part of the ship. In Case III not only have the above effects to be considered, but drift has also to be taken into account, as the gun is not laid by aid of the sights.

The Responsibility of the Fort Commander.—Now, with the exception of the group difference, all these corrections have to be evaluated and applied, either by or under the authority of the fort commander. Not only has the range to be measured by the instrument, but the net correction has to be arrived at, and matters so arranged that it is not a distance only, but a corrected distance, that is transmitted to the group dials. So also as regards training; the gun layer is responsible either for the line over the sights or the position of the pointer, but the fort commander governs the movements of the deflection leaf, or takes measures, in Case III, that the necessary corrections are embodied in the transmitted training. No instrument absolves the fort commander from this responsibility; corrections always have to be made, they only differ in kind. When firing has commenced, observation is the great aid to correction; but the above disturbing effects are not constant in their influences, and have always to be borne in mind. It is unfortunate that but little real experience in observation of fire can be gleaned from our so-called "service practice."

The Position of the Fort Commander.—Now arises this question: as the correction and observation of fire is so difficult a matter, how can its performance by a fort commander, be reconciled with efficient and disciplinary control of his men? My contention is, that the two things are perfectly compatible, if proper arrangements exist in the work, and if the officer is able to regard matters from the standpoint of their relative importance for the time being. The first necessity is a properly chosen station, inside the fort, for its commander, its requirements being as follows: There should be a clear view of the waterway commanded by the fort; in an open work, gun emplacements should be in sight, if possible, but at all times they must be within easy reach; there should be a pedestal for a D.R.F., an instrument that should always be at hand, whether the P.F. is installed or not, but the distance of this pedestal from the furthest group should not exceed 200 yds., for if it is greater one set of group differences will not be sufficiently accurate for all ranges; the station should be roomy, weather proof, clear of the blast of the guns in firing, and be provided with a table to hold maps and other useful articles; it should be connected, electrically, with that of the section C.R.A., while easy means for communicating ranges, orders, &c., of the kind best suited to the individual work, should exist between the fort commander and his subordinates. Sometimes two stations of this sort should be provided, either for the avoidance of smoke or other reasons. In an open work it is often possible for a fort commander to have the

greater part of the armament under his eye; in a casemated work, he is bound to be on the roof, but even there, he is practically as much with his men as if he were actually on the gun floor, where probably two detachments at most would be aware of his presence. The true power of an officer over his men is obtained by his methods of dealing with them and their knowledge of his character, and the conviction that he will know how the work is going on, when not actually on the spot. It is only during firing that he need be at his station, but in action it is no more necessary for him to be looking after petty details of drill, than it is for a squadron leader in a cavalry charge, to concern himself with the dressing of the rear rank. We must demand something from discipline. I put it forward as an axiom, that as long as a fort commander is inside the work, he is in touch with his men.

When the P.F. is being used as the range-finder an apparent difficulty arises, in carrying on the work, from a station as above described, but it is *only an apparent difficulty*. In order to obtain the full value of this instrument, it is generally installed outside the fort, so as to be removed from the effect of smoke,¹ and, formerly, it was the invariable custom for the fort commander to place himself at this observing station, leaving a sub-commander to represent him in the work. Now it must be understood that each group of guns has its own P.F., and the "gifted individuals" who work them are not "trained officers of iron nerve and wide experience," but simply young gunners or N.C.O.'s of good eyesight and intelligence, who are instructed as "specialists," and paid as such; they are, in fact, glorified gun layers. Moreover, most works, where the P.F. is installed, have two or more groups, and as it was impossible for the fort commander to be with more than one instrument at a time, he usually stationed himself in some convenient central position, whence he could see the waterway and communicate with his observers, by voice or orderly, generally by the latter. There is no reason he should not do, from his station in the fort, all that he used to do at the observing station, and at the same time have a most efficient control over the fire.

We have just commenced to use portable telephones, and last year very good results were obtained with the Siemens-Halski, when officers were not afraid to use it. In the past, telephones have been discredited a good deal by bad selection and improper usage. Lines seldom go out of order; they should be laid permanently, and admit of being tapped readily, terminals being placed at all necessary places. Receivers, transmitters, bells, &c., should be kept in store, and joined up only when the fort is got ready for action; it is essential that all their parts should be easily accessible to inspection, nothing closed up permanently, and all "gym crack" fittings forbidden. Telephony has made great progress in civil life, it should be easy to supply the wants of the coast artillery.

The essentials, then, are good telephones and sufficient practice,

¹ By placing guns and instruments at different levels, mists, peculiar to certain localities, are prevented from interfering with the laying.

and that being understood, the fort commander should be at no disadvantage, as far as his observers are concerned, and be also in the best place for fire control. The method works with the greatest ease, when this officer speaks directly to a sub-commander at the observing station, telephone orderlies and all the old cumbersome method, being discarded.

Moreover, it may sometimes happen, that certain corrections can be better made by a sub-commander at the P.F. observing station, or even by the observer himself, than by the fort commander. At such times, the latter should not hesitate to avail himself of their services; the utmost flexibility of procedure should not only be allowed, but be practised, for, whether it be permitted or not, assuredly the fort commander will avail himself of it in action, not from any want of respect for established order, but from the force of circumstances. In making use of the eyes and positions of his subordinates he delegates but does not abrogate his functions; he should always hold the strings, for his office is to command, but, as they say in the law, *qui facit per alium, facit per se*.

Gun Laying with Time Shrapnel.—There is a fourth method of laying, which might be employed with time shrapnel against quick objectives. It consists in preparing salvos of time shell for several suitable ranges, following either with P.F. or D.R.F. and firing, when a certain range, corrected as usual, comes on the dial, the gun layers having kept the sights on, for line.¹ Electric firing from the P.F. observing station could sometimes be used with advantage.

Gun Laying without a Range-finder.—If the gun is any height above the sea, 100 ft., say, or over, a combination of quadrant and tangent elevation serves as a rough range-finder; that is, the quadrant elevation, for some range, short of an approaching object, is given to the gun, and the tangent scale is run up to the corresponding graduation, and the gun is fired when the line over the hind sight and fore sight passes through the object. I believe Colonel French, late Chief Instructor at Shoeburyness, has been working at a range-finding sight on this principle; if successful it would appear to fulfil a desideratum with Q.F. guns.

Under this heading of the "Laying of Guns," I wish to draw attention to the following points:—

1. That the "fighting" of guns in a fortress differs materially from either sea or field service, and points to the necessity for regimental training.
2. That continual and more extensive practice is required by officers in choosing the proper methods of fighting their guns and changing, without friction, from one system or "case" to another.
3. The necessity for a common-sense view of the duties of fort commanders, so that they should not be tied down by pedantic considerations.

¹ It is only at very short ranges, and when the object is moving swiftly across the guns, that this presents any difficulty.

4. *The fallacy of laying down anything like fixed universal rules in the matter of communications.*
5. *The necessity for experiments to find a suitable telephone.*
6. *The proper understanding of the real use and position of range instruments.*

II. *The Choice of Ammunition.*

This is, generally, the duty of the fort commander. At one time there appeared to be a good deal of complication connected with this subject; we will soon, I think, be content with very simple rules, and the first of them would be, that the normal projectile for coast artillery is a common shell with a direct action fuze.

Common Shell.—The efficiency of this projectile is unquestioned, (1) against horizontal targets, at long range, or when fired from guns mounted for high angle fire, especially in salvos, and (2) against all unarmoured or lightly-armoured portions of the vertical target. There is, however, a point which appears doubtful to some, and which, at all events, would be better for elucidation. Since, in the case of direct fire against a ship carrying any armour, common shell striking the vertical protection, near the belt, would be wasted, our object should evidently be to pitch the shells well up, so as to secure hits above the impenetrable portion. Now come the questions—How will common shell behave that fall on an upper deck at angles of, say, less than 10° ? What will their effect be, if burst by striking deck hamper? Can we count on their penetrating the structure to any great extent before they burst? Seeing that the deck, especially to guns on a high site, furnishes the greater part of the virtual target, as the enemy approaches, the possibility of its efficient attack, by direct fire, is very important. From this it appears that shells should be as heavy as possible, and it is open to question if it would not at times be wise to adopt reduced charges to ensure a steeper fall for the projectiles.

Armour-piercing Shot.—With regard to armour-piercing shot, I think it is fully realized that, unless the armour is very much over-matched, they should not be used. The comparative immunity the

"Huascar" enjoyed, with her $4\frac{1}{2}$ -in. iron plates, against the 9-in. guns of the "Shah," has already been quoted in this theatre. Indeed, there appears to me but two occasions when the use of the armour-piercing shot is indisputable: (1) When, by use of high angle fire, we can make sure of penetrating the horizontal armour of an anchored ship; (2) when battle-ships are pressing home an attack, and their range and position render their "vitals" vulnerable. This, of course, leaves out of consideration a lucky shot under the belt during a roll, which, I presume, is a matter of pure chance. Of the above alternatives, the second is not likely to occur often, but suppose it were to, it appears to me that even then, all but the heavier guns should fire common shell or percussion shrapnel against the deck—perhaps, but certainly against any insufficiently-protected portions, or the vertical target

Shrapnel Shell.—That shrapnel shell, with a percussion fuze, could often be used as common shell, has always been recognised; but, not long ago, time-shrapnel was a discredited projectile; it may be the natural answer to a torpedo-boat attack. It is said that the balls are effective up to 300 yds. from the point of burst, but as their individual weight varies in different heavy shells from 2 oz. to 8 oz., it appears desirable to determine by experiment, what is the lightest ball that can be relied upon to penetrate modern torpedo-boat plates up to 3,000 yds. range, say. Naturally the lighter the ball the greater their number, and the more extended their effect. The next question would be—What height above plane should the shell burst to be most effective against the actual target presented, for I think it would vary with the class and position of the boat. When the balls of a shrapnel strike the water, their "pattern" may be enclosed in an elongated oval, something like the figure (see Fig. 2.) The relative dimensions of this figure vary, of course, with the range and height of burst, but it is found, I believe, that the balls are much more closely packed towards the rear, and that about half would fall within the shaded area, which may roughly be described as circular. Experiments of this sort could well be carried out over a sand range, and from their results, local schemes could be drawn up, which would depend on armament, waterway, and probable line of attack.

Case Shot.—This is a deadly projectile, at close range, against anything floating that is not absolutely protected. However, opinions differ as to its efficacy against light armour, such as torpedo-boat plates; experiments appear necessary in order to lay down limits of power and range, and also to determine the best sort of ball.

Cartridges.—On mobilization, as soon as a fort is confided to an officer, the largest batch of cartridges of similar brand should be examined and weighed, and the whole of the ammunition should be carefully inspected and arranged, so that by no chance should any alteration in its service take place, without the fort commander's knowledge. Rounds at known ranges should be fired as occasion offers.

Under the heading of "Choice of Ammunition," I wish to draw attention to the following points:—¹

7. *Can vessels be efficiently attacked by the direct fire of common shell and percussion shrapnel on their upper decks, and how far can we utilize reduced charges?*
8. *With regard to our own defences, are there many places where the close attack of battle-ships is possible or probable, and how far should this affect the equipment of armour-piercing shot?*
9. *Are there occasions where a blow from a solid projectile would be more detrimental to an unprotected ship than a common shell of the same calibre burst inside her?*
10. *The necessity of experiments to obtain data as to time-shrapnel and case shot.*

¹ These points are numbered consecutively through the lecture to facilitate reference.

III. *The Control of Guns.*

The objectives of coast artillery are either (A) vessels at anchor or (B) vessels in rapid movement.

Under A may be classed—

- (1.) Ships carrying out, at long or medium range, a systematic attack on forts, or attempting to bombard something defended by the forts.
- (2.) Ships supporting by their fire other ships attempting to run past the forts.
- (3.) Ships that have anchored at short range to effectually crush forts.

Under B may be classed—

- (1.) Ships that attempt to run past and at the same time fire on the forts.
- (2.) Ships that attempt to run past without firing.

Control by Section C.R.A.—In A (1) systematic fire tactics could be opposed to systematic attack: careful identification of the enemy would be carried out, and objectives and even projectiles would be notified to fort commanders: the section C.R.A. would hold a rigid control as long as possible, and distribute his fire to the greatest advantage. The usual installations of telephones and charts, or telephones and indicators, meet the requirements of this service.

In the case of A (2) the control could not be so rigid; the duties of the section C.R.A. would be restricted to seeing that while the supporting ships were kept under fire, the true attack was not neglected.

In case of A (3) taking place, control would have passed into the hands of the fort commanders, as it must whenever the objectives have rapid movement; then, control by the section C.R.A. would be liable to lead to confusion.

Looking at what our probable duties in war will be, from a common-sense point of view, it appears to me that in the majority of cases the duties of this officer will be more preparatory than executive, but they are duties of the highest importance. Apart from those of any military commander, he must see that his section is properly organized and prepared, that ammunition is sorted and ready, that range-finding arrangements and communications are complete, and possible breakdowns provided for; he must take especial care to keep himself in touch with coastguard stations, &c. Immediately on mobilization, he would consider the plans that should have been drawn up in peace time for his guidance, and see how they should be utilized or modified, in view of present events, and then, he should explain to all his fort commanders, as far as it is possible, what their action should be, in case of probable eventualities. Here naval assistance would be invaluable.

Coast defences designed to prevent ships running past, would usually have the section C.R.A.'s position well advanced: he would

thus, when an attack was imminent, be often able to send useful information to his subordinates: during the actual attack he might find it necessary to draw attention to any vessel that appeared to be escaping punishment, but beyond this he could scarcely go. If the time for interference and non-interference is not thoroughly understood, great confusion might arise, especially if an officer, new to the work, suddenly found himself in command. The telephone is a dangerous plaything.

Control by the Fort Commander.—In the great majority of cases, the fort commander will control the fire of his fort; that is to say, he will exercise full discretion as to when, what, and where to fire, *except* in so far as he is restricted, either by orders previously given, or by the propriety of the section C.R.A. keeping the control in his own hands, as above explained. There should be a normal method laid down for fighting each fort, but the fort commander should always be ready to change the "case" or mode of firing, whenever occasion demanded, and he should have a plan ready, in his head, in case of breakdown in any part of his gear. As long as he is engaging one objective he can keep the complete control in his own hands, and it is evident, in such a case as B (2), when the ships cannot return his fire, he can give his whole attention to the waterway; in special cases, as when guns are mounted for high angle fire, and fought by a P.F. placed at a distance, he would even leave his men and go to the observing station. The officer responsible for the fire must see the waterway, *coûte que coûte*. But if a fort has to engage two objectives simultaneously, the fort commander can, himself, only direct the fire against one; he must give up the control of the guns engaging the other to some officer, who, in that case, will practically exercise the functions of a fort commander. Each objective engaged requires at least one range-finding instrument.

Under this heading of "Control of Guns," I wish to draw attention to the following points:—

11. *In many places elaborate measures for identification and indication of objectives are useless, if not mischievous.*
12. *In each locality, a line of action should be sketched out for the section C.R.A. by superior authority.*
13. *Schemes of defence should be drawn up of a practical nature, so as to be useful to officers of the rank of fort commander, new to the locality; great advantages would accrue if there could be more collaboration between officers of the rank of section C.R.A. and C.R.E. and representatives of the Royal Navy, in these matters.*

IV. The Placing of Guns.

The Site.—Efficient protection should always give way to efficient working: both are attainable when a high site is chosen. The higher the site, the more accurate the gun, the larger the virtual target, and less bad effect is caused by errors in range or elevation and mistakes of all sorts; deck attack is easier, range finding is more

accurate, and a suitable place for the D.R.F. can usually be found. In fact, the ranging of guns, when no high ground is available, is a difficult matter, not only on account of the unsuitable station that must be given to the fort commander, but also because the special depression range-finder for low sites is unreliable, if not more than 30 or 40 ft. above the sea, unless it is kept in the most perfect adjustment and used for ranges not exceeding 2,000 yds. It is to be hoped that the horizontal P.F. will get us out of what, at present, is a difficulty. In addition, with a high site, an attack cannot be pressed home, which, we are told, is considered by many sailors the proper way to deal with forts.

Q.F. guns should always be placed high for the following reasons:— They have often to be fired at an unmeasured range; tangent elevation and a high site minimize the effects of errors in estimation: the method referred to as Colonel French's can be applied, and may solve a great difficulty. Shots from a Q.F. gun striking the deck of a torpedo-boat are apt to glance, and yet these craft offer an almost horizontal target; now the higher the site the less this liability will be. Mine-fields, booms, &c., are often protected by Q.F. guns on either flank; if the latter are placed near the sea level, as is sometimes advocated, accidents from cross fire may well occur, which could be prevented were the guns higher up; at the sea level they would also be at a disadvantage, as compared with those on board ship, whereas command would in many cases ensure immunity, at all events, from short range fire. As their trajectory is flat, it is said that when placed low, their fire will have a long dangerous zone; it must, however, be remembered, that their axes will, as a rule, have to be at least 5 ft. above mean tide, and this, added to the curvature of the trajectory, small though it be, will tend to diminish the zone in question: in addition, all shots that do not hit the narrow freeboard or small conning tower of a torpedo-boat will probably glance.

Grouping Guns.—The guns of a fort should be collected into as few groups as possible, subject to the following conditions: all guns in a group should practically have the same field of fire: they should be of the same calibre and nature, they should not occupy a greater frontage than will admit of their being efficiently overlooked by the group officer, nor must this be of such a length that at extreme trainings there should be any serious difference of range between the flank guns of a group, all the guns of which are fired at the same range. This frontage should never exceed 40 yds. (see Fig. 3). It is also desirable that, when a group has fired its salvo, it should be possible to reload and lay, without the detachments being endangered by the fire of neighbouring groups; at extreme trainings also, individual guns will interfere with each other; this matter should be carefully considered in designing the fort.

Q.F. guns ought, as a rule, to be grouped clear of a fort; their commander practically exercises the function of a fort commander.

The points I wish to draw attention to under this heading of the "Placing of Guns," are:—

14. *The importance, in all cases, of a high site.*
15. *The necessity for greater attention to the requirements of group control in placing guns.*

V. *The Selection of Guns and Mountings.*

Type of Gun.—Common shell being the normal projectile and shell power our principal means of offence, it appears to me that, with a certain sum of money to spend, there should be a very strong reason indeed for substituting a gun of weaker shell power, for an old type gun of greater shell power. It is, I believe, a fact that a 6-in. B.L. gun on a H.P. mounting costs the same as a 10-in. R.M.L. on a barbette, while the weight of their respective common shell bursting charges are as 1 : 3, giving the new gun the advantage of its cast steel shell. If, now, a cast steel shell were made for the older gun, and seeing that effect of burst varies somewhere as the square of the weight of powder, surely, of the two, the 10-in. gun would be, by far, the most effective, if the two classes of mounting were both permissible from other causes. Moreover, there would be but little difference in the rate of fire.

Mounting.—With regard to mountings, they should be as simple as possible; a little weight or general unwieldiness may be forgiven as long as they can be worked by hand and do not require much supervision. On mobilization, we shall have to depend on a good deal of untrained assistance. Our beautiful H.P. carriages I look on, as necessary evils, only to be resorted to from dire necessity.

Guns for High Angle Fire.—Likely anchorages for an enemy can most efficiently be defended by guns mounted out of sight, inland, worked by Case III, in connection with a well-advanced observing station. No vessels in existence could remain under an efficient fire of this kind for any length of time. In applying it, range presents little difficulty, but training has to be carefully considered, on account of the great effect of wind and drift. If dynamite guns can only be perfected, they seem to have, here, an ideal rôle.

Q.F. Guns.—In certain places, the newer type heavy Q.F. guns would constitute, of themselves, an efficient defence: they are simply medium ordnance superbly mounted. In addition to these, however, there has been a tendency of late to exalt the use of the lighter and mere auxiliary types, at the expense of the ordinary armament. No doubt, as weapons they are excellent, but where shall we get men to work them, especially in the early days of mobilization, without denuding the heavier guns of their detachments? In the hands of untrained men Q.F. guns are worse than useless. I am also of opinion that many of the objects they are supposed to fulfil, could be equally or better carried out by case or shrapnel. I do not believe in firing them into haze or smoke to "sweep" a waterway; there would be a certainty of great waste of ammunition and a probability of considerable danger. They have their place, no doubt, but should not supersede, to any great extent, the heavier guns: they should be on cone mountings and be fired from the shoulder; field carriages are

unsuitable for coast work, and mobility would only be a source of confusion, especially at night. Coast artillery has no mobility, it must depend on its long arm and its heavy blow.

Case-shot Guns.—When it is required to cover with *mitraille*, the neighbourhood of a boom, the opening of a harbour or a mine-field, close at hand, special guns, to fire case shot, are an efficient means of defence: if on opposite sides of an approach, they should be mounted with traversing stops to prevent any chance of their firing into each other. See Fig. 4.

The question of choice of guns is a large one, and, to a certain extent, outside the scope of this lecture, I, however, wish to draw attention to these essentially artillery aspects of it:—

16. *The desirability of heavy shells and simple mountings.*
17. *The difficulty of efficiently manning a great number of Q.F. guns and the possibility of the guns of the forts themselves performing many duties, apt to be assigned to the Q.F. guns.*
18. *The use of case-shot guns for protecting waters within short ranges.*

VI. What may be expected from Guns.

Possible Accuracy.—Gunnery in peace has the following advantages over gunnery in war:—The nerve strain of battle is absent: there are no casualties: there is no surprise: there is no fatigue: the work is seldom done in really bad weather, and scarcely ever at night; observation of fire is not interfered with by any confusion, as to where a certain shot comes from; the objective is never hidden by smoke, and, on account of the danger, practice is never carried on, when fog and haze exist; ranges change so slowly, on account of the speed and direction of the target tugs, that the difficulties of corrections for travel, do not crop up and are not realized. On the other hand, as each round is so expensive and consequently so few are allowed, all firing has to be carefully used for instruction: detachments never fire a large number of shots under the same conditions; observers, gun layers, methods of firing, &c., are continually being changed: the targets fired at are small as compared with ships, and real rapidity is interfered with, from safety considerations. While there is thus something to be said on both sides I think the great difference between peace and war should be fully realised, and I, for one, would be very loth to form in my own mind any ambitious theory; at the same time, I feel that the power of the guns is apt to be underrated.

I have myself seen some excellent results at a Hong Kong target, going 8 or 9 knots, such as 20 rounds, fired from five guns in 7½ minutes, all falling inside a virtual target, 12 ft. high by 30 ft. broad; and last year the whole of the practice in the Isle of Wight, some 500 rounds—practice which was chiefly instructional, and sometimes carried out in a way that precluded accuracy for line—gave us one hit in every three rounds, on a target 12 ft. high by 31 ft. long. However some of these results come under the head of “calculated hits;” that is the line and the longitudinal error were observed, and the hit was determined, by the known angle of descent. Discredit has

sometimes been thrown on this manner of scoring, so I will put some results before you, which were obtained on a *record* target, actual hits only being allowed to count. The target was 36 ft. long, 12 ft. high in the middle, and 9 ft. high, for a distance of 12 ft. at each end. (See Fig. 5.) It was so heavy, that it had not a greater speed than 5 or 6 knots, and ranges changed but slowly, giving an average of 2,200 yards. Against this target six companies of the southern district, carried out their competition practice, each company firing on a different day. They together furnished 6 fort commanders, 6 range-finding detachments, 22 group officers, 44 detachments, and consequently 44 gun captains and gun layers; of the last, half were chosen by the officers commanding companies, and half were determined by lot from the registered layers of the companies. Each company fired 16 rounds from 4 guns; one weak company only furnished 4 detachments, so that each of these fired 4 rounds; but in the other cases group officers and detachments were changed after each had fired *two rounds only*; half the rounds were by single gun and half by group salvo.

The weather on the six days varied from windy and rainy days to almost perfect ones, and from those again to days on which there was a dazzling glare in the gun layers' eyes.

The firing took place from Sandown Fort, an old casemated work whose interior arrangements were very defective; the guns were 10-in. R.M.L., 30 ft. above the sea. Case II and D.R.F. were employed, the instrument being on the roof, about 45 ft. above mean tide. Reduced charges were used, which, according to the range tables, reduced the accuracy, very nearly 50 p.c.; at all events there was no doubt that the wind had considerable effect on the high trajectory. There was, occasionally, interference from smoke and fouling of ports, but the average of the actual times taken by each company, was $12\frac{1}{2}$ minutes. Of the 96 rounds fired, 44 were hits upon the target. For the sake of comparison, I have put to scale, on the figure (see Fig. 5), the virtual targets presented by this record target, and by a 1st class torpedo-boat, a torpedo-gun boat, and a cruiser, taken from the "Naval Annual."

Effect of Smoke.—A great deal has been said about the effect of smoke in obscuring a range: it is of course all a matter of wind, or rather the absence of wind; a gentle breeze blowing down the range is the most annoying; thus, one of the companies above referred to, was stopped for $2\frac{1}{2}$ minutes, owing to the slowly moving smoke, drifting in the same direction as the target. But as far as this went, there was only one bad day in the six; a high wind soon clears off the smoke. I have seen, in some night operations, the effect of barrels of pitch, being lighted on a ship's deck, so as to enclose her in a veil of smoke; dense clouds rose up all round her, and though she was passing through an area, illuminated by many thousands of candle power, we could see absolutely nothing of her hull. We, however, knew her range, approximately, from her position in the channel, for now and again, we could see shadowy lines, which we knew to be her masts, and we could easily have fired on her with effect. I think the effect of smoke is apt to be exaggerated.

Under this heading of what we may expect from guns, I wish to draw attention to the following points:—

19. *May we not now claim that in daylight, with well trained men, actual hits on a target representing a ship, should be numerous, in view of the experience detailed above, where many of the conditions were the reverse of favourable and the target so comparatively small?*
20. *Is it not now time to qualify that oft quoted and very sweeping dictum that "for ships to run past forts, where no obstacles exist, is a comparatively easy matter"?*

VII. The Action of Guns at Night.

Respectable opinions vary greatly as to what can and cannot be done by an enemy, under cover of fog or darkness. It is, I fancy, very much a question of locality, and here, the guidance of our naval *confrères* would be invaluable in drawing up schemes of defence; for the brain of an ordinary landsman reels in presence of the many *ex cathedra* statements that are made.

Electric Lights.—The question of electric lights is in an unsatisfactory state. There was a beautiful theoretical simplicity about our early idea, of noting vessels as they passed through a fixed beam, and passing them on from light to light, the whole being controlled by the section C.R.A. This would be a patent method for rendering torpedo-boat attacks easy. The creation of a large and brilliantly illuminated area, which was also tried, might work well if a very large number of pieces bear upon a narrow obligatory place of passage. It seems to me, however, impossible to make certain of stopping, at night, a swarm of torpedo-boats, gallantly pressing home an attack, by defences at one portion only, of a channel. Where the defences have depth it is a different matter, the advanced guns putting those in rear on the *qui vive*. What amount of depth of defence will render a channel secure is, I fancy, at present doubtful; it would depend, in a great measure, on the answers to some of the questions already referred to. From what I have seen of night operations, I am convinced that, as a rule, search lights are more convenient than fixed beams. Colonel Watkin's dials have given us an excellent means of controlling them from *any* station, but as a rule I should prefer to see them normally under the fort commanders, subject, of course, to any orders the section C.R.A. may give. We should, however, not leave the arrangements for electric lighting to be settled under the pressure of imminent war. It is no easy matter to place them safely to the best advantage, and the present uncertainty is a serious embarrassment to the preparation of practical schemes of defence. It is of course a matter of expense.

Electric lights might be supplemented by parachute lights, fired from mortars. Two or three specially constructed mortars of small weight, placed at a fort commander's station, might give him the means of keeping his front illuminated, during the progress of a

torpedo-boat attack. This could easily be determined by experiment.

Illuminated Sights.—This is also a pressing question; there are many technical reasons why Case II is better than Case I at night, so electric gun sights should be of the straight-edged pattern. A contrivance of this sort was unofficially tried, with success, at the Isle of Wight two years ago; there does not appear to be any difficulty about the matter.

An illuminated tangent sight is a necessity for Q.F. guns: we had a modification of the naval sight in use, but we found that it was impossible to lay, with a full sight, as by day. This is very important from our point of view, and a simple alteration was proposed by one of our assistant instructors, Sergeant Kirby, recommended and sent forward; I have not heard of it since. It would also be well if the elevating wheel of this sight could be manipulated by a man, other than the gun layer, so that the latter could keep his line, while the elevation was being altered, either by direction of the gun layer or the group officer or fort commander. It would also seem desirable to experiment with combined quadrant and tangent elevation, as before noted. On many nights in the year you can lay perfectly with electric sights, without search lights or other artificial illumination; on many occasions their absence renders the guns useless. It is a technical matter, and, in my opinion, they are a crying necessity.

Microphonic Detectors.—If these instruments can be perfected they would render the defence, by case-shot guns, an easy matter by night.

Identification of an Enemy and Rules of Traffic.—The measures to be taken at night, to distinguish between friend and foe, have, no doubt, been thought out for each locality. It would, however, be wise to familiarize officers with the procedure that will be in force in war, or, at all events, to let them think it over. At the present moment, the question "What am I to do if I see or hear a swift objective approaching?" would be a matter of considerable embarrassment to many fort commanders.

The points I wish to draw attention to under this heading of "Action of Guns at Night," are as follows:—

21. *The necessity of the immediate placing of the E.L. question on a more stable basis, and of experimenting with parachute lights, &c.*
22. *The necessity of providing and practising with electric sights.*
23. *The necessity of the junior ranks, being accustomed to realize in peace the procedure that will be followed in war, as to the identification of approaching vessels.*

VIII. Requirements for Training Personnel.

Companies of Royal Artillery.—Individual training has its uses, but by far the most valuable kind is that, where officers and men work together in units. The late improvements in this respect are well known, as far as the Garrison Artillery is concerned; but it is very difficult to carry out efficient training with the present allowance of

ammunition; there is, however, little likelihood of its being increased. The panacea is the establishment of practice batteries, so organized that 64-pr. projectiles can be fired by all the different methods and cases. But this must in no way interfere with familiarizing all hands with the forts themselves.

It is not the actual firing of a few guns in a fort of any size that effects this; a group of guns is practically the same thing, wherever it is placed: what really is of value, is the testing the communications and range finding arrangements of a work, and a very great deal can be done by manning, as for war, without actually expending ammunition. Testing of mountings and familiarizing men with them is fully met by "station practice," but the larger works, often from lack of men, often from barrack accommodation being mixed up with gun floors, have, in certain respects, to be neglected, with the result that no one knows how they should be fought.

Militia Artillery.—The training of the Artillery Militia has relatively advanced *pari passu* with that of the regulars; they now settle down quickly into a fort, and usually do very good work; it is, however, often the case that in each brigade there are one or two officers, who seem to absorb the greater part of the good of the training, leaving a residue who do not attain to anything like the same efficiency. Now in a fighting force we want a good general average. It also is a pity that no means seem to exist, for keeping up the knowledge obtained, periodically; but, speaking generally, in the Militia, we have a magnificent reserve.

Volunteer Artillery.—The training of the Artillery Volunteers has not progressed as it might have, and this is certainly not the fault of the Volunteer officers, who so freely give us their money, time, and intelligence. But there has been for this force, as far as I know, no training of the unit, which is the only real training for Coast Artillery. Some of the officers may have seen, as from a Pisgah, a land flowing with range and position finders, but the greater part of the force are still in the house of bondage, trying to make bricks without straw.

There is no doubt that officers of both Militia and Volunteer Artillery want more help in their training. The literature of a new subject is not always easily understood; the tools of the trade require to be handled, and, perhaps in the past, there has been a little over-elaboration, so that many an anxious student has found himself in the position of the man of Ethiopia, who when asked by the Apostle "Understandest thou what thou readest?" replied "How can I, except some man should guide me?"

The points I wish to bring to your notice are—

24. *The necessity for practice batteries.*
25. *The desirability of testing the communications and the handling of our larger works.*
26. *Facilities for Militia officers to keep up their knowledge between trainings.*
27. *That the Volunteer Artillery, whom we shall have to depend on in*

the early and dangerous days of mobilization, should have more opportunities for practical training, and more ammunition to fire.

When the Council of this Institution did me the honour of asking me to read a paper on Coast Defence, I was very pleased to accept the invitation. Three years' experience of a practice camp has convinced me that the efficient service of the guns of a fortress is one which cherishes and produces the highest military qualities: smartness, coolness, self-reliance, and discipline; and I find, in the subject of Coast Defence, much to admire, much to interest, and much to learn. Our present position is accurately represented by a clever little picture, by whom I know not, which was supposed to show the state of the Field Artillery. In it, a gunner stood firmly planted on the Rock of Progress, but his boots were still encumbered by the mud and slime of the Slough of Despond, out of which he had struggled. In the distance towered the Peak of Perfection, but his road, even to its base, was barred by a yawning chasm, the Abyss of Fads. Still the drawing was full of hope, for over this ugly gulf was thrown, a strong plank of Common Sense.

Major F. G. STONE: I rise with some diffidence, as a junior officer, at the commencement of this discussion. I am sure we must all feel grateful to Lieut.-Colonel Jocelyn for giving us the benefit of the latest ideas on the question of coast defence obtaining at our most highly valued camp of instruction. Colonel Jocelyn's arrangement of "pegs" on which to hang discussion is a very happy thought upon which I congratulate him. I am glad to see that as regards "laying" the advantages of Case II are fairly given; in advocating the use of Case II whenever possible the lecturer is reflecting the opinion of every practical coast gunner that I have met. As regards the position of Fort Commander—for I observe that the familiar term is adhered to, as opposed to "Fire Commander"—I cannot quite agree with the lecturer that in Case III the Fort Commander should be in the Fort. I take it as an axiom that Case III would never be employed where Case II is possible, therefore when Case III is adopted it implies that there is difficulty in the observation of the target from the Fort. The responsibilities of the Fort Commander are clearly laid down in the lecture, and it is difficult to see why these responsibilities should be delegated to a sub-commander in the Fort Commander's P.F. observing station, in order that the Fort Commander may remain in the work and be nominally in touch with his men. I will quote the lecturer's own words in support of my argument. "In action it is no more necessary for him to be looking after petty details of drill than it is for a squadron leader in a cavalry charge to concern himself with the dressing of the rear rank." The very conditions which render Case III necessary, instead of Case II, appear to me to be so many arguments in favour of the Fort Commander being in the P.F. observing station in order to assume the higher functions of command, delegating the mere supervision of the details on the gun floors to a sub-commander. "Gun laying without a range finder." Under this head the adoption of a well-known principle is advocated: this principle has been ingeniously worked out practically by Colonel French. I have had some experience of this device, and cannot concur in thinking it suitable for Q.F. guns: it is too slow in operation, depending as it does on a succession of predictions and being non-continuous as a range finding instrument. I believe that Q.F. guns will find their range much more rapidly by trial shots; this, however, could easily be proved by trial. I believe I am reflecting naval opinion on this matter. I believe the best range finder for Q.F. gun is the Q.F. gun itself. Of course any range finder or position finder which might give approximate range, if it happens to be handy, would be of great value in order to determine the elevation for the first round. Under the head "cartridges," the following statement is made: "Rounds at known ranges should be fired as occasion

offers." May I suggest to Colonel Jocelyn as an amendment to this, "Rounds with a time fuze should be fired as occasion offers;" in other words, let us get some data as to how our fuzes will burn before going into action, as if we begin firing time shrapnel at a moving object without such data, our fire may be wasted. The subject of time shrapnel is a difficult one when considered relatively to a moving target. The plan of loading certain guns with shrapnel, fuzed for a certain range, can only meet the very simplest case, viz., that of ships being compelled to keep a certain course without deviating much to right or left; in other words, running through a channel. It is, moreover, somewhat wasteful of armament, as it amounts to holding certain guns in reserve for a special phase of the fight when their fire might be valuable all through the fight. The subject is somewhat severely "let alone" in the drill book. It is not stated who is responsible for length of fuze or correction of fuze, nor how correction for different groups in the same fort, firing at the same target, can be carried out. To my mind the best way would be for one or two trial rounds to be fired, that is before the action commences, and the Fire Commander, or F.C., to give the necessary correction for the day, e.g.—"10 per cent." That order goes to all the group officers. The control of the shrapnel fire at a moving object should then naturally fall to the group officers who would set their fuzes according to the group range at which they intended to fire their next salvo, when orders have been given by the F.C. for shrapnel firing by group from right or left, as the case might be. The F.C. could assist the group officers by informing them of the position of burst so that a further possible correction might be made in the setting of their fuzes the next round. I cordially agree with the lecturer as to peg No. 15. The opinion of the C.R.A. ought to carry great weight in the selection of sites, &c., in order that this requirement may not be lost sight of, that is to say, grouping the guns, making your site with the view to get the largest number of guns into the group, and at the same time not extending the guns on either side more than the minimum amount allowed by Colonel Jocelyn as a requisite which would very likely be lost sight of by any but an artillery officer accustomed to supervise the fighting of forts. I cannot agree with the lecturer in his strictures on the extended employment of light Q.F. guns in opposition to the case and shrapnel fire from heavy guns at torpedo-boats. I have trained detachments to use Q.F. guns, and have no hesitation in saying that their manipulation is much more readily learnt by any intelligent non-commissioned officer or gun-layer of Volunteers than is the more complicated service of a 10-inch R.M.L. gun, taking as it does a detachment of 15 men. There is an immense saving in the number of men required, which in another way Colonel Jocelyn made a great point of. You can do the same work with far fewer guns. There is no tendency to flurry when engaging a rapidly moving object, inasmuch as the layer knows that if his first or second shot does not hit there is no harm done, since the third and fourth will probably fall on the target, and from the nature of Q.F. guns he can follow that target with a continuous running fire which can be kept up and corrected with ease the whole time the target is within range. This certainly is not the case with the heavy gun, where he practically puts all his eggs into one basket, viz., the basket of that one shot. The typical gun for work against torpedo-boats appears to me to be the 1-pr. Maxim with automatic action. This gun is not in our service, I believe, though I cannot understand why it is not introduced, it being in every sense the most economical and efficient weapon for the purpose advocated.

Colonel F. T. LLOYD: I cordially agree with Major Stone in eulogizing the system which Colonel Jocelyn has adopted of giving us certain pegs on which to base our discussion on the subject which he has so ably brought before us this afternoon, because I think it will keep us from dwelling too much upon what I cannot help calling the fads of artillerymen, which I am afraid are very numerous. Among the number of points which Colonel Jocelyn's lecture raises, I must select one or two of the more prominent. The position of the Fort Commander is a very important question, and one that I have always had very much at heart. I am told by artillery officers that if the F.C., as he is called, does not put himself on the gun floor with his men, he will lose all control of them: they will not think very much of an officer who does not share their danger and their work. My view of a F.C. is that he has to fight his guns to the best of his ability, and in order to do that, he

must place himself where he can best observe not only the effect of his own fire but the action of the attacking force, whether ships or men. All other considerations must give way to that most important duty. What will suit the Isle of Wight will be very unsuitable, perhaps, for Garrison Point Fort, or the new defences at Aden, Malta, or Gibraltar; and, again, the treatment of these must differ from such a line as that connecting Southsea Castle with Eastney Fort, where we have a number of 6-in. B.L. guns spaced very widely, and where there are exceedingly difficult questions of command involved. As to gun laying with time shrapnel, I really do not think that that is a very effective projectile against any probable attacking force. I do not quite see how you are to decide at what point it will be best to open fire; and you have also this difficulty, that you have half a dozen guns laid with different lengths of time fuzes, and at different elevations, and if your vessel does not come within the range of those elevations and the scope of those time fuzes, your guns are practically spiked, they are useless; you cannot draw the charge, because of the gas-check. A system of that sort cannot be a successful one. We had better rely in these cases on quick-firing guns. As to the use of shrapnel generally, [that must depend upon the nature of the target, for time shrapnel, even by day, would probably be useless against anything but boats. I think percussion shrapnel or even unfuzed shrapnel may be used with effect at moderate ranges, against unarmoured ships and the unarmoured portion of armoured ships, and they would be a most valuable projectile. With reference to the preparation of a scheme of defence, Colonel Jocelyn says: "In each locality a line of action should be sketched out for the section C.R.A. by superior authority." There I am rather at issue with him. He says "sketched out," and I daresay he only means hinted at; but I think that the section C.R.A. is the man on whom should devolve the preparation of those schemes of defence, and that those schemes should be most carefully thought out by the local authorities, who must not allow themselves to be too much hampered by so-called general principles. I say with a full sense of my responsibility that the local authorities *must* have a free hand for every work of defence, and must, in short, work out their own salvation, in conformity with, but not in subjection to, general principles. They are the responsible people, and on them should devolve the scheme of defence. Major Stone dealt with objections to Colonel French's process of range finding. One of the great objections to it was that in the case of heavy guns, the same process had to be repeated every time the gun was fired, on account of the recoil. If it had not been for that, I think his suggestion was a very valuable one. Now, a word or two about the selection of guns and mountings. Colonel Jocelyn compares the 6-in. B.L. gun with the 10-in. R.M.L. gun, and so far as the power of their shells is concerned, of course I agree with him, but I think he must take into consideration not only the weight of shell that can be poured in in a given time, but the localities in which it is proposed to place these hydro-pneumatic mountings. They are intended mainly for low sites, where in the presence of Q.F. guns, 10-in. R.M.L. guns, whether firing through ports or open embrasures or *en barbette*, could hardly be used in the present day; their detachments would be obliterated in a very short time; therefore these hydro-pneumatic mountings are forced upon us, but should be reserved for low-site batteries. I now go on to point 20. "Is it not now time to qualify that oft-quoted and very sweeping dictum that for ships to run past forts, where no obstacles exist, is a comparatively easy matter?" I do not think I am guilty of a breach of confidence if I allude in the most general manner, of course, to a confidential document which has just been issued by that very authoritative body, the Committee on Naval and Military Defence. They deal with this very subject of ships running past forts, very briefly and very much to the point, and I think those who are interested in that matter could not do better than study the decision which is there laid down as to that very point. The gist of it really is that ships will not run past forts unless they can obtain a space beyond the forts out of gun fire, wide enough to turn in, in order, I presume, that they may run back, so I think the cases of running past will not be of very frequent occurrence.

Colonel JOCELYN: Is the probability of their running past discussed in the paper?

Colonel LLOYD: No, but they will not attempt to run past unless they can turn

in an undefended area. Colonel Jocelyn suggested parachute lights for night work. I do not think they will be found very satisfactory. Parachute lights have been used, as everybody in this theatre knows, for many years past, up to a large calibre, and the objection to them has been that the area which they light is very small, and that the light thrown over that area is but a mere glimmer. They have been pretty well abandoned, both for the defence and attack of fortresses, and have been superseded by star-shell. Before leaving the subject altogether, I think it would be well if some of the distinguished officers present would be willing to throw some light upon the following points that I have still to touch on. We must consider first, when arranging for coast defence, what would be an enemy's object in approaching any point of our shore—I do not say the shores of England, but the shores of any part of our Empire. These objects can be very briefly specified. First, the acquisition of a port or fortress as a naval or military base—that covers a great deal of ground; secondly, for raiding purposes, either by torpedo-boats or cruisers: and, thirdly, to enable them to land at an unprotected portion of the coast line, in fact, for invasion. Now, the *consensus* of opinion generally points, I think, to the teaching that the navies of foreign Powers will make no attempt on any of our fortified places so long as they are thoroughly well manned and armed. We shall have no recurrence in this country nor at any of our coaling stations, I trust and believe, of the experience of Alexandria in 1882. I think that may practically be dismissed so long as we keep our armaments up to date and our men drilled. But raiding by torpedo-boats and cruisers is highly probable, and will be a great feature in the war of the future. The third object is landing at an unprotected portion of our coast line is possible, but unlikely; but any one of these may be forced upon a foreign Government either from political necessity or some popular movement, so that we may consider that we have to face the possibilities of every one of them. As to the first of them, what we require most for our ports is the protection and the perfecting of our communications—telegraphic, telephonic, whatever they may be. They are not costly; they bear no sort of proportion to the cost of our forts and guns and stock of ammunition, and yet they are not perfected, and very slow progress is made with them. Then the provision of the cheap adjuncts which are required for satisfactorily working a system of guns, whether placed in a fort or in isolated emplacements; and, lastly, we want more elasticity in the scheme of defence. I do not think it does to lay down—and Colonel Jocelyn mentioned this—any hard and fast rules as to the position of a Fort Commander or details of that kind, which ought to be settled on the spot. We want elasticity; we want the F.C. to be supreme in his district. The section C.R.A., as he is called, is the officer who initiates the whole thing, who plans the scheme in conjunction with his advisers, and the F.C. is the individual who carries out that scheme. The section C.R.A. is a purely consultative and administrative officer, and has practically nothing to do with fighting the guns, except to give the F.C. such information as comes to his knowledge. That is my view of it. Another thing in which we fail is rapidity of fire. Our artillery fire is far too slow. We must encourage, by every possible means, rapidity of fire, and rapidity of fire cannot be insured without those adjuncts of which I spoke just now. It is hardly necessary to insist upon the necessity, but if we consider for one moment the advance of artillery science and the progress of science generally connected with steam power, quick-firing guns, and so on, what would have done very well 30 years ago, when we had 68-pr. as our best armament, will not do now when we have 6-in. Q.F. guns. As to the question of torpedo-boats and other craft at night, I am afraid we are terribly behindhand. No satisfactory scheme for stopping torpedo-boats going up a channel has yet been devised, and it would appear that we must rely for stopping them on some sort of mobile defence, in fact we must rely upon the navy. I cannot see at present that any arrangement which we have made from the shore, except in covering very narrow channels, has been the least satisfactory. I come last to the landing on our shores, and I have only a word or two to say on that point. Our policy at the present time is that in case of an attempt at landing on our shores, our force is to be concentrated in inland positions. I think the principle of that is exceedingly good, but it should not be enforced to the entire exclusion of the occupation of the coast line. On my part of the coast, in the South-Eastern

District, we have, as you all know, a very extensive series of Martello towers, and I cannot help thinking the ancient masonry of which those towers are composed would prove a very effective obstacle to anything but very heavy guns. They are not very large, and on the greater part of that coast, as you are well aware, large ships cannot come in close to the coast line. Every vessel that came in close enough to fire at them would have to be of very small draught. I do not think we must depend the least in the world for prolonged defence on these towers, because they could be breached or taken by assault, but they might be utilized by having a Q.F. gun and a machine-gun mounted in each of them. They should have a garrison of about 7 men. I have worked out the prime cost of arming the number of Martello towers which are available for this purpose, and it comes to something like 150,000*l.*, including a stock of ammunition. That is not a very large expenditure, and I think for the sake of delaying, if only for 24 hours, the advance of an enemy inland, something should be done to check them at our frontier. That 24 hours would be of incalculable value for purposes of mobilization, and for the concentration on the inland positions of the large force of Regulars and auxiliary troops which we expect will be placed there.

Colonel RICHARDSON: It is rather difficult to criticise a paper with which in the main you agree. The chief difficulty that a lecturer on coast defence meets is the fact that one general system does not suit the requirements of every locality. It is very natural for anybody who writes a lecture to found general principles on his own experience, but his own experience, as a rule, is only that of a few places, and therefore it is very difficult to dogmatize. In some minor instances I disagree with him. He lays down that all the groups of a fort should command the same waterway, and all the forts of a section should fire on the same line of approach. How does he reconcile this axiom with the case of the breakwater fort at Plymouth, which fires over two waterways? With Case I, he says, fire is more accurate than with quadrant elevation. I feel he is talking only of the service method; but I maintain quadrant elevation might make shooting perfect. What we want is a hydro-chronometer which is simple, which has large divisions, and a movable scale and zero to compensate for tide and powder error. That, you might say, is a very difficult thing to get, but I have seen that sort of hydro-chronometer. Captain Donohue, I.O.M., produced one some years ago. It was quite in the rough, but some little practice took place with it, practice of most remarkable accuracy. Again, the lecturer says, "quadrant firing is only possible with the P.F." I think it is quite possible that with any R.F. good results might be obtained. I am glad to see Colonel Jocelyn has adopted the term "Fort Commander." As to their proper position, we get a difference of opinion. Major Stone and Colonel Lloyd both think they should be well away from their men, but I cannot see the slightest difficulty in their being generally inside their forts. They can control the fire equally well and yet be with their men, so near them that they can at any time visit them. I have seen no difficulty about it anywhere, except in the case of high angle fire, when I think F.C.'s must be as near to the target as they can be, so as to see fire effect well. The lecturer lays down that there should be a pedestal for the D.R.F. I think there ought to be many of these D.R.F.'s in every fort. It does not follow that you are only going to engage one ship. In peace practice we fire at only one target, or at most at two. We have not very many men, and the consequence is we are apt to think that one D.R.F. is all that is required; but some groups will be silent because there are not enough D.R.F.'s in our forts. I am very much in accord with the lecturer as to his ideas of how communications should be worked, except perhaps on one or two minor points. As to the pegs he gives us on which to hang discussion, I agree with the principles of very nearly all of them, and merely propose to touch slightly on those with which I cannot quite agree. The first is No. 5, where he speaks of the necessity for experiments to find a suitable telephone. I cannot help asking, Why telephone? because the telephone is a very bewildering instrument, at the best, in wind or noise, and I think we have found that the telegraph, or perhaps the printing telegraph, is better. I quite agree, however, that some experiments should be carried out to find out the best instrument for our wants. Then as to the choice of ammunition, he says the normal projectile for coast artillery is a common shell

with a direct action fuze. The common shell is certainly the normal projectile, but I think, if we do have a direct action fuze, it should be slightly delayed. There is no difficulty in that, because fuzes with very great delay have been produced. In No. 7 he asks, "Can vessels be efficiently attacked by the direct fire of common shell and percussion shrapnel on their upper decks, and how far can we utilize reduced charges?" Our object is always to cripple a ship, and not to kill a few men. We want really to break up or sink the ship itself; the men must follow, and therefore we should not use reduced charges. Some people think shrapnel should be used against unarmoured ships, but it is unlikely that shrapnel will cripple a ship so much as the very large charge contained in common shell. Admiral Cleveland has seen quite lately common shells fired causing frightful destruction behind plates, quite enough man-killing effect without a few weak bullets added to it. Then with regard to No. 8, I suppose there ought to be a few armour-piercing shot, in case any ship was foolish enough to come up close and engage a well found fort, but otherwise I do not think there is any place where ships will attack us at very close ranges if we are properly prepared. It is all going by theory, but it is difficult to conceive an instance in which a solid projectile striking an unprotected ship would do as much harm as 20 or 30 lbs. of powder or high explosive bursting inside her. Then we come to No. 10. I do not know that time shrapnel in the ordinary sense will ever suit our purpose very well. Of course I suppose the lecturer means for use against torpedo-boats chiefly. This brings in rather a large question, which necessitates a good deal of thought. The navy have elected to meet the attack of torpedo-boats with Q.F. guns, but I am not quite sure whether Q.F. guns are the best for coast artillery purposes. I should like to see this discussed instead of the mere question of time shrapnel. I have heard opinions expressed in the navy that the mere penetration of the outer skin of a torpedo-boat will not stop it; it is too big game to be stopped by small shot, you want a big smashing bullet for it. That I do not know, but I think, both in the coast artillery and in the navy, each man holds his own theoretical opinion, for want of real war experience. In many cases of narrow channels, rapid-firing case guns would probably be very awkward things for torpedo-boats delayed by booms or other obstacles. Some of the enormous number of hits must prove effective. The lecturer appears to have touched rather lightly on the most difficult problem with which coast artillerymen have to deal, and that is the defence (which Colonel Lloyd laid some stress on) against torpedo-boat raids; that is the only thing we have now left to provide against if our heavy armaments are kept efficient; but here again we have not real experience to guide us. I was very anxious a little while ago to start a small torpedo-boat-opposing school, but I unfortunately could not get the funds to do it. We should have learnt a very great deal if we had devoted ourselves to producing extremely swift moving torpedo targets, perhaps covering them with some sort of light armour, and trying what we really could do by night and day. We might have found, perhaps, that the Q.F. gun is the best defence. I do not think the navy yet realize what will happen in an engagement where torpedo-boats come on quickly, how in the act of self-defence they will peg away into each other with these Q.F. guns, which have very long range. I know we coast artillery will not be long allowed to fire into opposite shores, into towns, &c. Under the head the "Control of Guns," No. 11, he says, "In many places elaborate measures for identification and indication of objectives are useless, if not mischievous." I think that in all places if these means are too intricate they are mischievous, but in most places a simple system, such as Captain Orde Browne has been good enough to work out for us, could not do harm, whether you use it or not. No doubt some will use it, and I hope we shall get it issued soon. "In each locality a line of action should be sketched out for the section C.R.A. by superior authority." That line of action is laid down fairly well in our drill book. The section C.R.A. ought to be an officer of some considerable experience, and if he is too much tied by rule he won't act at all. Then the lecturer says in No. 13 that "Great advantages would accrue if there could be more collaboration between officers of the rank of section C.R.A. and C.R.E. and representatives of the Royal Navy in these matters." The result would be the coast artillerymen would have a great many advisers. I have

a good many friends in the navy, and I get a good many different opinions from them. Are we to have one section working one way and another the other way, according to the opinions of their respective naval advisers? I do not think that is desirable. The best way is for the C.R.A. to be in communication with the principal naval authority of the district and then give his orders. The C.R.A. of the district must be the head, he must have everything under him; it won't do for each junior to go his own way. Then as to Nos. 14 and 15, I hold very strong opinions. I think the lecturer is very sound throughout, especially in laying stress on a high site wherever it can be obtained. There are lots of places where we see high sites available for all-round fire, and a lower site chosen. There is some mention made about the automatic sighting of Q.F. guns. There are sights already invented that would do very well indeed, if made practical; they only want working out. If anybody will make the trunnion sight movable instead of the tangent sight, he will see how very easily an automatic sight can be devised. It was first suggested by a Volunteer officer, Captain Grant, a very clever man, some years ago, and I cannot see at all why his ideas should not be enlarged and adapted to range finding with Q.F. guns. It would be perfectly automatic. On this system, whenever you laid the gun correctly on the object the gun was ready to fire a shot at the range required. It is a very promising idea where high sites are available. I agree with the lecturer about the utilization of old guns. I suppose he was thinking of 6-in. H.P. when talking of substituting guns of weaker shell fire for the old type guns. Many of our old type guns are slow in firing, but they are cheap and never get out of order. I disagree with Major Stone that the Volunteers cannot work them; I think they work them very quickly and very well.

Major STONE: I did not imply that at all. What I said was it is easier to train a detachment with your quick firers than the detachment of a 10-in. gun which consists of 15 men.

Colonel RICHARDSON: The Q.F. gun takes very long training, and an enormous number of rounds must be fired before you can expect the men to hit; whereas with the 10-in. anybody can shoot well. We do not get much ammunition for 10-in., but we make very good practice. Owing to its two motions the quick-firer proves very difficult to any man, even though he is a good layer with ordinary guns. Elaborate guns will certainly be sooner out of order than the old simple weapons. Then about Q.F. guns, how they should be placed. The lecturer says they should be on cone mountings and fired from the shoulder. With that I quite agree. They should be cone mounted, put on a truck, to move where you like to selected positions. He says "Coast artillery has no mobility." You can get it in that way; we could bring any number of Q.F. guns to any required spot. We find that they fire very well from trucks. You have only to run a railway round about the works and you have very considerable mobility. I am glad he has called attention to the ill effect of smoke being exaggerated. I am a very strong advocate for smokeless powder, but smoke does not so very often interfere with shooting. Then about ships running past forts. I believe history will always repeat itself and ships will always have the power of running past forts. It is only a question if the defences are very efficient; if they are, ships will not do it without receiving a very great deal of damage, and will they run the risk of losing a very large fraction of their power for nothing? What are they going to do when they get by? Are they going to run into a lot of submarine mines? I do not think they will attempt to run past except in fairly open channels. As for electric lights, we want experience. The small, trifling trials that we have had have taught us little; but I agree with the lecturer that search lights are far more effective than fixed beams. I quite agree with him that search lights for the fighting of a fort should be under the F.C. every bit as much as his guns. On the question of illuminated sights, I see he hints that they must be electric sights. There is a great craze for electricity; it is to do everything; but I have a sort of idea that the simplest sight, and the best, would be one perhaps in which electricity had nothing whatever to do. The thing we want is not so much an electric sight as a perfect sight, which can be altered in its brightness so as to suit different states of atmosphere. We want something we can use effectively by night. I quite agree that on many nights you can lay perfectly with ordinary sights, without search lights or any artificial

illumination. I go further. I believe there are very few nights in the year in which you could not lay guns without the electric light; and there is one form of lighting up a channel that never seems to have been noticed, that is putting lights on the far side of it. You can see a ship perfectly well in shadow, and you can use the range finder. The lecturer thinks the subalterns, or the younger officers, the junior ranks should be accustomed to realize in peace the procedure that will be followed in war as to the identification of approaching vessels. Well, there used to be a good old rule that hardly ever failed. It has stood the great test of war. Fire a shot ahead; if the ship stops she is probably friendly, if she does not let her have it. She will either stop herself, or we shall stop her. The necessity for practice batteries I quite agree with; we ought to have more practice batteries, because of the difficulties of our home ranges, but I would not have a practice battery at all if it had the effect of preventing us practising from service batteries. Then there is "The desirability of testing the communications and the handling of our larger works." At one place the lecturer has made the statement that nobody knows how some of these large works are to be handled. I have a fair experience of our forts, but I do not know where this state of things exists.

Major F. B. ELMSLIE, R.A.: As regards the Fort Commander's corrections, Colonel Jocelyn has enumerated, *seriatim*, a formidable number of these, for tide, for travel of objective, for powder, for time of flight, and so on. These are doubtless all necessary, but I should like very earnestly to put forward that to attempt to treat them each as separate corrections is somewhat misleading, as practically these various corrections have to be merged into one at any given moment. The attempt to treat them separately is very discouraging to officers who have to be Fort Commanders—as it induces the feeling that the task is more difficult than it is in reality. The officer should make his corrections on seeing where his projectiles are falling, without reference to what may be the exact cause or causes of any error he sees. If when firing at a moving object he sees his projectiles strike beyond and behind his object, he should simply correct his range and deflection, instantly and boldly, by what he estimates as the amount of the error, and carry on the firing without a pause. This plan saves a lot of time, and I am sure if it were always put in that way, we should train our Fort Commanders quicker and easier than we do at present, for it is confusing and discouraging for a man to feel that he has such a lot to think about at critical moments. Secondly, seeing that corrections are unavoidable, I should strongly advocate taking up the subject of applying them mechanically. It is very difficult for anyone, however well trained, to apply these corrections in his head, and this is a weak point in our system. It can be done mechanically, and if our authorities will only take it up as a subject to be considered, I have no doubt that a very good result could be arrived at. One other point is that Colonel Jocelyn apparently expresses a preference for the heavy shell of the 10-in. R.M.L. on the grounds that it is a bigger shell. That is perfectly true, and the gun is a good gun, but in these days when the objective is likely to be under fire such a very short time, it surely is more important to fire with rapidity. You may waste two or three shots from the very best gun, and rapidity of fire is probably more important than a great big shell which is wasted if it does not hit the object. Fourthly, as regards fuzes, which have been mentioned in the discussion, I cannot think that time fuzes, used as such, can ever be very manageable in coast artillery work. But it is very important to be able to expend your shell, if possible, after ricochet, to prevent it damaging friends, so if some time action could be appended to the direct action fuze so that the shell, if it missed the object, would be expended automatically at long range, it might simplify the matter of cross fire in narrow channels. Lastly, about Q.F. guns, there is no doubt that the rate of fire is, in these days, of the highest importance, and the more their command is simplified the better. I quite agree with Major Stone that the proper range finder for the Q.F. gun is the Q.F. gun itself: these guns should also, as put forward by Colonel Richardson, be used in groups of a mobile nature, that is to say, the guns could be transferred to different points. If you tie yourself hand and foot with every gun in a fixed position some attack of an unforeseen nature may find a weak spot. If the lighter Q.F. guns are properly mounted, and movable, we shall have in our hands a great

power for defence. The effect of a group of four 6-prs., well handled, is very great, and it would be a very good thing if we were supplied with more of these for coast purposes.

Colonel C. H. COLES: I should like, as a Volunteer artilleryman, to say a few words, especially as an officer who has not only "stood on the top of Pisgah," but has also entered into "the land flowing with range and position finders," and to say I thoroughly endorse the suggestions made by Colonel Jocelyn on the subject of training the Volunteer artillery. Although the Volunteer artillery commenced to learn the duty of coast defence immediately the Red Book was issued, still a course at one of the schools of instruction enables us to grasp the spirit of the system a great deal better, and I would recommend such a course to any officer who can spare the time. The idea of 64-pr. practice batteries and more ammunition will commend itself to all, especially to those brigades which are stationed near sea ranges, but in places like London, where we are 50 miles from a practice battery, the difficulty of travelling expenses comes in very heavily. The Government only grant travelling allowances on one occasion for one man per annum. I would, with very much deference, with regard to the training of artillery, offer the following suggestions:—In the first place, that guns of the same nature that the Volunteer artillery are called upon to man in the forts generally—9-, 10-, and 11-in. guns—should be issued, say, in the proportion of 1 to 300 men; those guns should be complete, with mountings, fittings, &c. By this means much valuable time would be saved by instructing the men in gun drill at their own drill stations, thereby enabling the unit to proceed at once with the drill series or service practice when in the forts. My contention is that it is really a waste of valuable time to have to instruct Volunteer gunners in the drill of these guns in the forts, the drill of which they ought to learn at their own drill stations, but which at the present time they are unable to do, because the guns are not forthcoming. Let us have a certain number of guns complete; they may be dummy guns, but let the mountings and fittings be complete, so that the men may know them thoroughly. Secondly, with regard to London, where there are 2,000 garrison artillerymen, I would suggest that Tilbury Fort should be more utilized as a drill station. I think Volunteer artillery companies might go down there five or six times in the year and carry out the drill series of the competitive practice, and possibly the annual gun inspection of the companies might take place down there. Thirdly, that in the practice which is carried out at Sheerness the firing should be as nearly as possible in accordance with the regulations for Service practice. I think these suggestions might be adopted without incurring large expense, and the ideas of the lecturer, with which I agree, might be made thoroughly workable.

Colonel JOCELYN, in reply, said: It is very late, and if I pass rapidly over the points various officers have raised it is from no want of feeling that there is a great deal to be said about those points, and some of them I should like to take time to amplify if possible. I would like to touch, however, upon one or two things, because I have been misunderstood as to my phraseology, and first, with regard to what Major Stone has said about the F.O. being in his observing station and carrying out corrections of fire; what I want to say is that the F.C., when he goes into his fort, does not know perhaps whether he is going to use Case I, Case II, or Case III, and he ought to be able to use any one at any moment as the necessity arises. In order to do that I do not think there is any cause for him to be in the fort. I never had the opportunity of seeing Colonel French's sight, and I bow to what Colonel Stone and Colonel Lloyd have said about it. I merely drew attention to it because I thought the laying of Q.F. guns at night, where the continuous R.F. is not always possible, might solve what appeared to us all the other day a great difficulty. Then with regard to the Q.F. guns; I myself do not know very much. Major Stone said you can do the same work with them with fewer guns. If he meant to say that you could do the same work with the Q.F. guns that you could do with the heavy guns I should like to know what he meant. With regard to the training of men, there is no difficulty whatever in training Volunteer artillery to work heavy guns when you have specialists existing in all the districts to do the special work, such as laying and so on, and I think it is much easier to train men with heavy guns than with Q.F. guns. With regard to what Colonel Lloyd said, the whole point of my lecture

was that what suits one place may not suit another. I am dead against tying down anybody. With regard to the section C.R.A. and the preparation of the scheme of defence, what I meant was that I have seen the mere fact of a man being supplied with large charts, with groups, squares, &c., has a tendency to make him interfere with the F.C., to give him objections, and to say, "What square are you on?" which is useless in a channel or in any place where there is an easier and speedier means of identification. I think Colonel Orde Browne's work with regard to what he has done for ships is most valuable. I did not mean to underrate it for a single instant; all I meant was, if you put a lot of tools into the hands of a man who is very apt to play with them, there may be danger. I think some officers will understand what I mean. I know the hydro-pneumatic carriage is forced upon us with some low sites. What I meant was I should like always to use the heavy shell when I could get it. With regard to rapidity of fire from 6-in. and 10-in. guns, I myself do not think there will be much difference. I have not had much experience with hydro-pneumatic mountings, but did I understand it would be slower firing with the 10-in. than with the 6-in.?

Colonel LLOYD: Yes.

Colonel JOCELYN: I bow to your opinion, because I have not had much experience.

Colonel LLOYD: I am sorry I cannot give you the figures.

Colonel JOCELYN: There is a great deal to be said for that, and I at once admit that rapidity of fire is of the highest importance. I think we ought to bear in mind the value of a live shell, that is what I meant. Then there is a point that Colonel Richardson mentioned with regard to deprecating naval advice to the section C.R.A. and the section C.R.E. We know that officers commanding artillery stations have the benefit of this conversation with Admirals and so on, and they seem to derive a great deal of benefit from it, and I cannot see why the junior ranks should not benefit in the same way. I only once in my service had the opportunity of close connection with the navy and the Engineers, all combined in the same operations in the Isle of Wight. It lasted for four or five days, and I learned more in those four or five days than I did in four or five years at any other time. I found it of the greatest use to hear what they had to say and to discuss matters with them. With regard to the mobility of machine-guns, of course Colonel Richardson and Major Elmslie have both spoken from what they have seen as to moving guns on trucks. There may be many cases in which that is excellent, but I have not seen it. I am only judging from my own point of view, that running about with Q.F. guns in the night may possibly lead to confusion. I do not want to draw any comparison between shrapnel and Q.F. guns, except in so far as this, that I do not think we know what shrapnel will do, and I merely want to have some experiments to find this out. I do not think I have been understood by some officers. They thought I was going to load up the gun and wait for the ship to come. A F.C. would have to use his wits. If he saw ships preparing to run through he would be perfectly certain to get the range. He could use his gun for other purposes until that time came. It does not take long to order guns to be used with shrapnel for a certain range. Then, with regard to correction, I do not think anybody will accuse us of frightening F.C.'s, for it is our object to make everything as simple as possible: and as far as doing it mechanically, I have written a paper in our own proceedings about that, which is merely another peg for somebody to see what can be done in putting on corrections for speed mechanically, because in certain forts the corrections are very important; and I do not quite go with Major Elmslie in saying you can correct from one shot to another, because the conditions change. I have a case in point. Here is a gun 14 ft. above mean tide, the corrections for travel are from 5,400 to 1,000: they vary like this, -125, -95, -50, -25, 0, +5, +25, +50, +100, +125, all on the same line. I do not think you can shoot well if you do not consider these things separately. There is the result of two corrections, and I do not think at all events the F.C.'s of the Southern District would feel that they have been in any way bothered by correction. If you can do it automatically by all means do it. Captain Cranpton, the gunnery instructor at Cork Harbour, wrote the other day about an automatic time correction, and I should very much like to see it tried. I am all for doing everything automatically and

making things as simple as possible. The only gist of my lecture was that what are merely matters of theory should be supported by practice.¹

The CHAIRMAN (Admiral Cleveland): It now devolves upon me to close the discussion. I suppose I ought to give a summary of the criticisms which have been

¹ With regard to the discussion that has taken place, I should like to make the following remarks. As to Colonel Richardson's criticism on my definitions of the "fighting units," I am aware that they were not quite complete. My object was to state the case as briefly as possible; a section may sometimes have to deal with two lines of approach, just as two fields of fire may be commanded by various guns in the same fort; but one S.C.R.A. and one F.C. can only deal with one of these things at the same time; should a section be simultaneously attacked from two lines of approach, the S.C.R.A. would have to delegate the charge of a portion of it to a subordinate, and if a fort is obliged to fire, simultaneously, on two fields of fire, there must be practically two F.C.'s. This is what I meant by "modifications of command."

Under the heading of laying of guns, I gave an account of certain corrections. It appeared to me that Major Elmslie misunderstood my object in doing this; I wished to bring out the real use and position of our instruments. I have always tried to simplify the duties of the F.C.'s. At the same time I feel sure that no peace practice brings out the real difficulties that may occur on service in correcting fire.

When I said that "predicted firing" was only possible with the P.F., I meant that this was the only Service method.

Colonel Lloyd objected to the firing of shrapnel time shell, as described in the lecture; it may, however, be worth experimenting with. I do not think the guns should be loaded until a suitable objective is in sight; but, in a given channel, certain obligatory ranges can be selected, and the shells got ready for loading. If the objectives were sunk, or turned back, before they reached the range the guns were prepared for, the latter can always be fired off and the shells got rid of that way.

As to Colonel French's sight, I have only heard of it, but never seen it. I cannot help thinking it would be useful, with Q.F. guns on cone mountings, in certain places.

With regard to Major Stone's remarks about the position of the F.C. when using P.F. Case III, I can only say that I think he should be in the fort then, as at most other times, if it was only in order that he may be able to change from one system of firing to another, as occasion may arise. Flexibility of procedure can only thus be obtained. Quite apart from this, there are other very important considerations which demand his presence there.

As to choice of projectile, I am very sorry no naval officer gave us the benefit of his advice.

With regard to the control of guns and identification of objectives, I by no means meant to underrate the valuable work Captain Orde Browne has done; on the contrary, I think it should be carefully studied by all officers of coast artillery. My meaning was, that somewhat complicated means for fire control would be better absent from a section C.R.A.'s station, when from the nature of the case such control would not be possible in action.

With regard to choice of guns, I wished to emphasize the importance of heavy shell; the example I gave was intended to start a discussion. I fully admit the importance of rapidity of fire, and it is always insisted on in the Isle of Wight; at the same time I think, as a rule, two salvos of 10-in. shell would be more effective than three of 6-in.

I know the question of Q.F. guns *versus* shrapnel is a very vexed one; my object was to demand experiments with the latter; the data on the subject is, as far as I have been able to ascertain, very meagre, and the decision as to which is best is much too important a one to leave to theoretical discussion only.

I mentioned parachute lights, as I had seen their trial recommended by at least two officers of experience; I was sorry to hear from Colonel Lloyd that his experience was dead against them; at all events the star-shell might be tried.

bestowed upon this able paper, but I do not intend to do so. The time is late and the subject matter too technical. In all the lectures on this subject which I have heard or read, there appears to be one weakness, that is, the authors do not seem to have a very definite idea what the *nature* of the attack upon our coast defences will be. My opinion is, that so long as we hold the supremacy of the sea (and I hope we shall never lose it, for if we do, no amount of coast defence will save us), the most probable nature of attack against which the forts guarding the approaches to our naval roadsteads should be always prepared, is the sudden and continuous rush of torpedo-boats; I do not think you will get anything more formidable than that; and it is to meet that particular form of attack that I should like to see some definite and settled plan of defence. Whether it is to be met, as Colonel Richardson suggests, by firing case-shot from heavy guns or by Q.F. guns, is a technical question, but one that certainly ought to be definitely settled. With your permission I will tender your thanks and the thanks of the Institution to the lecturer for the very instructive lecture that he has given us.

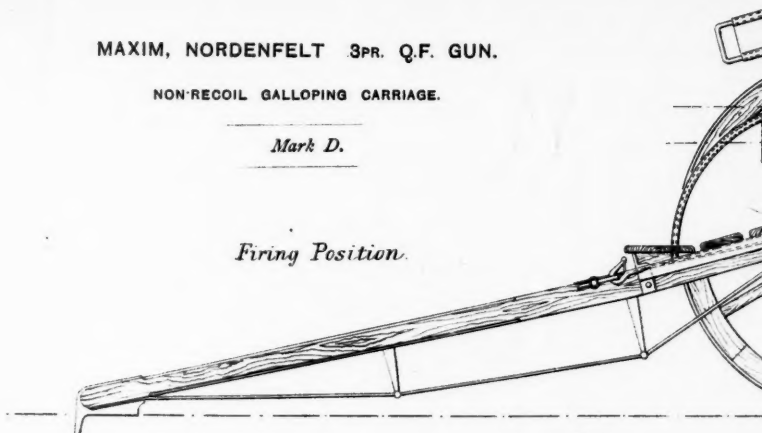
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MAXIM, NORDENFELT 3PR. Q.F. GUN.

NON-RECOIL GALLOPING CARRIAGE.

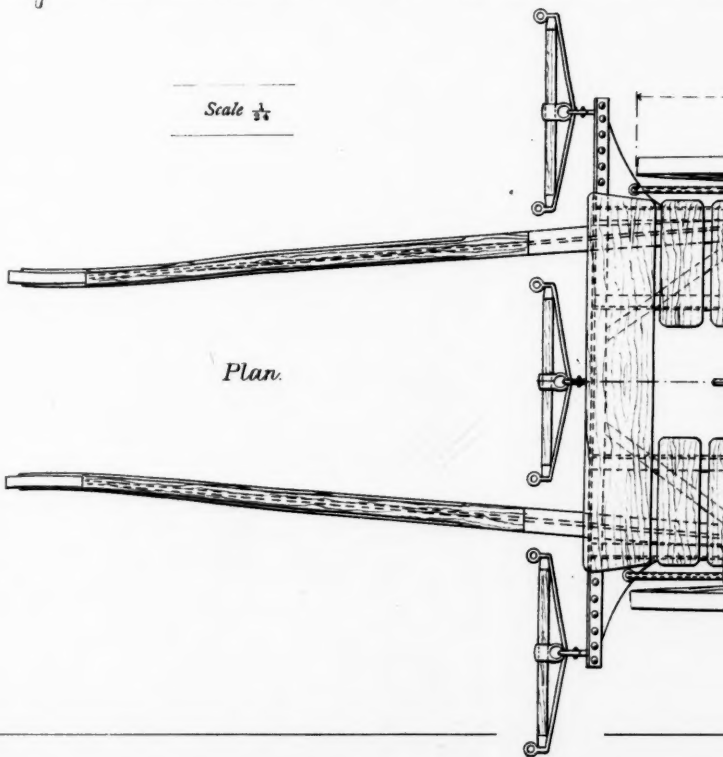
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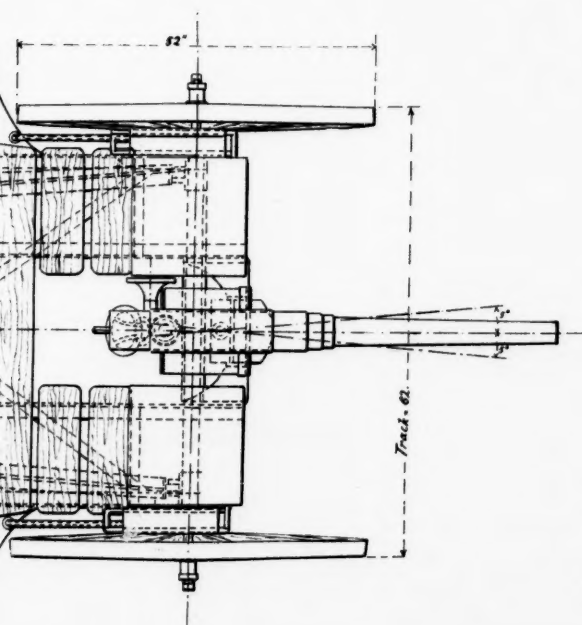
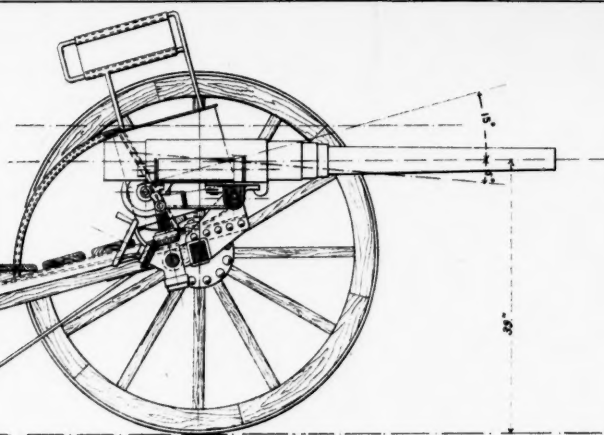
Firing Position.



Scale $\frac{1}{4}$

Plan.





Friday, February 23, 1894.

LIEUT.-GENERAL J. KEITH FRASER, in the Chair.

MACHINE GUNS WITH CAVALRY.

By Captain W. ANSTRUTHER THOMSON, Royal Horse Guards.

- I. Introduction.
- II. Idstone Manœuvres, &c.
- III. Matériel—
 - A. Transport.
 - B. Ammunition.
 - C. Range.
 - D. Sights.
 - E. Shield.
- IV. Personnel—
 - a. Detachment.
 - β. Scouts.
 - γ. Escort.
- V. Foreign Progress.
- VI. Conclusion.

I. INTRODUCTION.

It has sometimes been suggested that machine-guns should form part of a battery of artillery, but this idea has wisely been ignored, for although they might sometimes be so employed, especially as a 'safe-guard against cavalry attack, the true rôle of the machine-gun is in independent action.

The value of machine-guns for purposes of defence is generally admitted among nations, but, as our cavalry drill book so ably points out, these weapons can do far more than this, and there is now no doubt that, in taking part in a vigorous offence, reliable machine-guns will prove invaluable.

Let them push forward with the first line, if possible, wherever they may find cover, and dash out, as opportunity occurs, and take the enemy by surprise. A hedge, a hayrick, a cottage, a clump of trees, or even a heap of stones, will often furnish a hiding place for the occasion.

The gun presents so small a target, it is so easily concealed, it is so quick, so mobile, and so deadly, that when properly handled it should rarely be captured or put out of action. Now and again, no doubt,

one will be lost, but these dogs bite, and men and horses will think twice before attacking them, except under the most favourable circumstances; and if they serve their purpose it may pay to sacrifice them. It is easy to render them useless to the enemy: to carry away or hide the lock, or feed block, to jamb the bore, or to knock off the sight, would be the work of a moment. It is even possible to unhitch the gun itself and carry it off in one's arms for a few hundred yards, or otherwise to disable it; but a clean pair of heels will generally obviate that necessity.

Except when it is desirable to hide it, the cavalry machine-gun is of no use galloping behind the centre squadron of a regiment; it should be away on the flank, where it can best get a chance of manœuvring with effect; it is only in the way as a serrefile.

The gun commander must keep his eyes open, he must watch the enemy, and watch the ground, and watch his own force too. He must keep his line of retreat secure, if possible, and not allow himself to be taken in flank, or rear, or get too far away from succour. He must choose his positions well, and decide quick and travel quick, for it is one thing to select a position, and quite another thing to get there.

He must ever be pushing on, taking every short cut and advantage possible.

He must always be "there," but never in the way.

Cavalry machine-guns should seize every chance, not only against cavalry but against the other arms, especially artillery; to creep along a hedge, to get within range without exposure, to fire at guns, horses, and escort, at about 1,000 yds., will be a right task for a single gun, and if war has any likeness to manœuvres such golden opportunities will constantly recur.

There would be no waiting for an umpire then, and few would be the arguments urged against the machine-gun when it had played for half a minute at a fair target within that range.

At the same time it must be remembered that one well-directed shell will demolish the machine-gun, and it is only where sufficient cover is forthcoming that this can safely be done.

To illustrate the subject, I will now ask you to follow a machine-gun through the Idstone Manœuvres of 1893, showing the opportunities that may arise for such a weapon with cavalry in the field.

II. IDSTONE MANŒUVRES.

Battle of 4th September.

(Map 1.)

Position 1.—Our cavalry division was formed up south of Bishopstone Downs, north-east of Russley Park, while the enemy's advancing infantry approached to within 1,000 yds. of our entrenchments on Idstone Downs.

The cavalry division swept round and charged the infantry in flank, who at once formed groups, presenting a perfect target for the Maxim gun, as well as the artillery and infantry, on the hill overlooking them. At about the same time a battery of the enemy's horse artillery, appearing at the west of Swinley Copse, came under Maxim fire at 1,000 yds., and would have been destroyed.

Ammunition.—The 3,500 rounds laid down to be carried on the Maxim carriage would have sufficed for all this.

Remarks.—A squadron of our hussars was sent round to the right, east of Ashdown Park, and took a battery in rear.

Two squadrons were sent to the left to threaten the enemy's flank, but their attack was ineffectual.

Machine-guns with both these parties would have been of service.

Battle of 5th September.—First Phase.

Position 1.—Our brigade formed up under Fognam Clump until the order was given to attack the advancing enemy.

When our artillery took up a position to the south, on Bailey Hill, and our cavalry trotted north under cover of Kingston Down, the Maxim gun on their right rear.

Position 2.—Hearing the enemy's artillery firing to our right we galloped our gun to the brow, and opened fire at a range of 800 yds., taking them in enfilade.

The enemy's Nordenfelt, concealed at Half Moon Covert, turning its attention on us, we had to retire beyond the brow, but by this time the enemy's guns had retreated.

Here we were glad of our shield and our power of returning ten shots for every one of the Nordenfelt.

Position 3.—We then hurried after our cavalry, and arrived at the nick of time to catch two squadrons of the enemy in flank as they wheeled to the north to face the charge of one of our regiments round the old Warren Wood.

Here the battle was stopped.

Ammunition.—Ammunition would have sufficed.

Battle of 5th September.—Second Phase.

The brigade halted under cover of Hinton Down.

Position 1.—The Maxim hiding in the fir-tree strip to guard the right and front, while the artillery took up a position on the left.

Position 2.—The enemy's guns appearing at the clump north-west of Russley Park, we galloped to the tumulus on our left front, and there hid.

The hostile cavalry now showed itself north of Russley Park.

Position 3.—One squadron, charging to the south, came under Maxim fire at 600 yds., the gun galloping out and back so rapidly that the enemy's artillery would have had no time to take aim at it, they were besides busily engaged in a duel with our artillery.

Positions 4 and 5.—The main body of the enemy next advanced in

column, the Maxim playing on them from 1,200 to 400 yds. They charged our cavalry and artillery on the north side of the tumulus, but ignored the Maxim gun, which now poured a hail of lead into their flank at 200 yds.

Position 6.—The gun, of course, ran great risk of capture, and in the end a squadron surrounded it, but a moment later cease fire was sounded. The end attainable was worth the risk we ran.

Ammunition.—The ammunition on the gun would have been expended, but our reserve supply would have been close at hand.

Scouts.—On this day we had but one scout, and for some time not even one, as his horse fell head over heels, clipping a piece out of the gun wheel with his hind shoe.

We might easily have been surprised at the tumulus, and we felt most severely the want of proper scouts. Good men, well trained and well mounted are absolutely necessary to a machine-gun with cavalry.

Battle of 6th September.

From Old Warren, where we saw some of the enemy's scouts and a squadron of their hussars about a mile to the north-west, we galloped through Knighton Bushes on to Wellbottom Down.

Our cavalry and guns halting just below the ridge under cover from the enemy's artillery, some 1,800 yds. to the north-east, who now opened fire on the cavalry whom they had just seen.

The Maxim, under cover of the ridge some 400 yds. to the left, opened fire on the guns and escort for a few seconds at 1,800 yds., again withdrawing below the crest to guard our left and front from surprise.

Our brigade then wheeled to the left, trotting north towards Uffington Castle, under cover of Woodstone Down.

Our artillery taking up a position to the north of the clump, the Maxim on their right behind it.

Observing a squadron of the enemy's hussars halted west of the strip, we ran out and opened fire on them at 800 yds.

They at once took cover on the south side of the strip, while we moved so as to cover them if they emerged.

This they did, and were under Maxim fire for the space of 800 yds., within easy range.

Our cavalry had meanwhile charged the rest of the brigade which were drawn up to the right of their enemy's guns, and a furious combat was raging south of Knighton Warren Farm.

The above-mentioned squadron of hussars, although theoretically slain by Maxim fire, did yeoman service to their side by taking our men in rear.

As soon as they were gone we galloped to Knighton Warren Farm, taking cover under a hayrick, caught the enemy's artillery as they were limbering up at 800 yds.

The battle then ceased.

The position behind the clump was most favourable for the Maxim, and had it not been there, the squadron from behind the strip could

have done all the execution they got credit for, and more than this had they boldly charged our guns instead of halting where they did it is not impossible that they might have rolled the escort up and taken our guns in rear; a machine-gun on the flank will save many a day.

Ammunition would have sufficed, and reserve supply could have been at hand.

Battle of 11th September.

The Maxim took up a position behind a ragged hedge at the cross roads south-west of Uffington Camp.

A few moments later we found a contact squadron of our hussars retiring before a superior force of the enemy's cavalry. Allowing our men to approach to about 300 yds. we darted from our cover and fired down the road. Our squadron drawing off to the east as soon as they observed us.

The enemy retired.

The Maxim, supported by the contact squadron, advanced, and finding a squadron of the enemy halted over the spur of Woodstone Down, greeted them with a rattling fire at 250 yds., causing them to wheel about and retire at a smart pace.

Seeing the enemy's guns on Tower Hill we galloped into the hollow east of Pingoose Covert, the Maxim creeping out of sight to the end of the strip and opening on them at 1,000 yds.; our infantry meanwhile advancing on either side.

Perceiving a lot of dust over the rising ground, about 1,000 yds. south-east, we galloped to the brow anticipating a charge from the enemy's cavalry on the left flank of our line, but only found a squadron.

We opened fire at 800 yds., and caused them to retreat to Knighton Bushes; we now returned to the south of Pingoose Covert, and from thence galloped to Compton Bottom; here the enemy's squadron again came under the Maxim's fire, and two of their troops were put out of action.

Our infantry turning at Compton Bottom attacked the enemy's right flank, and seeing a good place among the old trees 200 yds. to the west, we galloped there and poured a murderous fire on the limbering guns and retreating infantry, who now had to leave their shelter trenches.

The contact squadron had by this time left us. Here we remained until Knighton Bushes were clear, and then galloped through them, checking at the further end till a scout reported all clear beyond. We then emerged, and seeing some squadrons of the enemy halted on the hill 1,000 yds. to the south, we opened fire and they retired.

We were now put out of action, having mistaken the enemy's Rifles for the Cameronians, who were on our side, a mistake which would have entailed our speedy demolition.

After an enforced halt of 10 minutes we made a fresh start, and climbed on to Kingston Down. Keeping under cover, as far as possible, till we reached the shelter of the Rubbing House; here

finding the enemy's infantry with a Nordenfelt in front of us, we opened fire at 400 yds.

Our infantry advancing as the enemy retired, at length reached the foot of the Down when the guards were attacked by a squadron, and a few moments later the whole line was charged by the enemy's cavalry brigade.

The Maxim and guns on the slope of the hill playing on them from 1,000 to 400 yds. distance.

Few could have escaped the combined fire of artillery, infantry, and machine guns.

Our force then advanced across the valley to attack the guns on Bailey Hill, the Maxim hiding under cover of Fognam Clump till a fresh opportunity should arise.

Here the battle ceased.

Ammunition would have been a difficulty in this battle, as we should have expended our allowance many times over, but there was nothing to prevent a fresh supply following in rear of our army.

Had the contact squadron remained with us we should probably have been saved the blunder that put us out of action, and the Rifles would have afforded a grand opportunity for a cavalry charge from the wood, and an excellent target for the Maxim when they formed square.

Battle of 12th September.

We were escorting a convoy, proceeding to Lambourne, *viâ* the Icknield way and south to the west of Ashdown.

Our advance guard, a squadron of hussars, accompanied by the Maxim, pushed forward along the Icknield way to within 400 yds. of Ashbury Folly. When a squadron of the enemy was found advancing towards them.

The Maxim at once galloped forward and opened fire at 400 yds., upon which the enemy took shelter under some farm buildings on their left.

We then observed from the cover of the hedge, the whole brigade of the enemy's cavalry advancing at a walk 800 yds. to our left. We at once opened fire and played upon them until they were out of sight, but no notice was taken of us.

The hostile guns now appearing on Tower Hill we retired to a position on the right of our artillery, where we found cover under a hedge and bank alongside of the mounted infantry.

Our cavalry was in rear of the clump and the convoy half a mile to the north under cover of the hill.

The enemy's cavalry charged our guns under fire of the mounted infantry, and the Maxim, from 1 200 to 300 yds., and were then met by our cavalry with the result that some of the enemy were put out of action.

Our cavalry then moved to the left to attack the guns on Tower Hill. The Maxim dashing forward to Odstone Barn to support them, opened fire on the enemy's guns at 1,000 yds. Our mounted infantry following in reserve.

We then galloped to Down Folley, firing again on the guns at 600 yds.

Thus ended the first phase of the battle.

The convoy proceeded along the Icknield way, turning to the south by the track leading to Red Barn. The Maxim being in rear, expecting an attack from that quarter. As we left the Icknield way the enemy's guns opened on us, but on reaching the cover of Red Barn, the Maxim came into action, and returned their fire at 800 yds.

Two squadrons of the enemy's hussars threatened our left from the north of Hayley Wood. We opened fire on them, but observing two of our regiments wheel about unseen by them, we tried to entice them on, trotting a little way and halting, pretending to be in trouble; thinking us an easy prey, they charged round the wood and were caught by our two regiments in front, and the mounted infantry at Red Barn in the rear. They were put out of action.

The attack in rear having been disposed of, the Maxim trotted on in advance, expecting work in front.

Arrived at King Alfred's Camp. We applied for a field troop as escort to help us to secure the road between Ashdown and Upper Wood.

Instead of a troop, two squadrons came with us, and the gun secured the road, but a rumour of an enemy's squadron over the hill to the south took the two squadrons away and the Maxim unwillingly accompanied them.

There was no enemy there and as we hurried back we saw the dust rising on the road we had left, proving that we were too late. The enemy's brigade now emerged.

Hoping that they would attack the convoy and that we should get them in rear we remained out of sight over the brow of the hill, but they discovered and two squadrons attacked us, forming a splendid target for the Maxim gun as they charged up the hill. We should have demolished a lot of them, although we were lost ourselves.

We were put out of action with a field troop of the enemy slain by the Maxim gun.

The ammunition on the gun would have been expended, in the first phase of the battle, but reserve supplies would have accompanied the convoy.

Battle of 13th September.

Arriving at the rendezvous at Fognam Clump we found the enemy holding Idstone Down. Our infantry advanced to the attack on both sides of Bottley Copse. Our artillery opening fire from Bailey Hill, our cavalry remaining under cover of Upper Wood.

The Maxim galloped to a position under cover at the east of Bottley Copse opening fire on two of the enemy's squadrons on the move at about 500 yds.

On our infantry machine-guns coming to this position, we moved lest we should attract artillery fire, and from the wall on the west of the copse opened fire on the enemy's infantry at 800 yds.

So soon as the hill was clear we galloped to the brow and caught the last line of retiring infantry in enfilade at 300 yds. Keeping the gun as much as possible under the hill, the muzzle only showing.

Finding further advance on the glacis impossible, we galloped under cover of the Down to Three Barrows, where we found shelter, and fired on the enemy at 1,000 yds.

We next advanced to a tumulus 500 yds. west of Harley Bushes, firing at retreating infantry and a squadron of cavalry at 600 yds., and then galloping on to One o'Clock Hill Clump we got a good chance at the infantry, on Two o'Clock Hill, at 900 yds.

Finally, on to Two o'Clock Hill, when our advance was stopped, to allow the hard pressed foe to retire to Lamby Down.

The ground did not admit of further advance until Lamby Down was clear, but we had observed a squadron of cavalry on the right flank and they now were halted at Starveall Farm, we were about to make an attack on them when cease fire sounded.

Here we were drawn into the infantry fight right away from our cavalry brigade, who eventually had a combat of its own on Hinton Down.

But we had left them halted at Upper Wood and had been hard at work the whole time. Unless specially ordered, it would have been folly to remain idle, while there was good work and good cover for us at the front.

This day showed me how useful fast machine-guns might be in an infantry fight on suitable ground, keeping under cover, galloping everywhere, popping up at unexpected places, and often securing the flank against attack from cavalry.

Ammunition would have been expended many times over, but reserve supplies could have followed us in rear.

In an infantry fight I believe there would often be time to gallop back and refill the ammunition boxes, but perhaps this manœuvre would be attributed to cowardice. With cavalry, however, this could seldom be done.

It was on this day that the enemy's cavalry Nordenfelt was captured by three or four of our hussars.

Battle of 14th September.

We were to defend the rear of an army retiring on Uffington Castle.

An infantry and artillery fight was taking place to the west, for the possession of Idstone Hill; our cavalry brigade was in reserve under cover of Red Barn; our horse artillery, with a mounted infantry escort, at King Alfred's Camp, while a party of mounted infantry was sent to Swinley Copse, to line the hedge to the west of them.

The Maxim halted behind a convenient haystack till affairs developed.

After a long wait, we observed that a party of the enemy's horse, about a squadron and a half, had approached to Starveall Farm, and were halted there, under cover from our guns. We at once galloped

to the best position we could find, and opened fire on them at 1,200 yds., and then, as this position was exposed to the enemy's shells, we took cover at King Alfred's Camp.

The enemy's party then emerged from Starveall Farm, making a sweeping charge to the north-east presumably with a view of taking our guns.

The Maxim galloped out from behind King Alfred's Camp, opening on them, from 800 to 400 yds.

The mounted infantry at the same time giving them a succession of volleys; they sought shelter at Parsonagehill Barn, but were put out of action. Cease fire then sounded.

This was the only piece of cavalry work that took place on that day, beyond a few mounted infantry being put out of action; and it was the last affair in which the Maxim took part.

I may add that during these manœuvres we had, on one occasion, six men hauling on to ropes to keep the gun from capsizing, and frequently we had three men pulling behind, as a drag down hill.

The gun never had to turn back from an obstacle during manœuvres, though of course we had to choose our places, and sometimes take the horses out to save the strain on our harness.

The same horses came out every day, and did a 37-mile march to wind up with without being sick or sorry.

The Gun on Service.

The following details from Matabililand I have learned from an eye-witness:—At the battle of 1st November, which took place in the afternoon, the Matabilis charged to within 140 yds. distance of the laager, when the rush was stopped by Maxim fire.

At the battle of the Shangani, 24th October, which was fought in the dusk, the nearest natives killed were but 50 yds. from the Maxim.

Most of the enemy were killed by the machine guns, their fire being steadier than that of the rifles, and the range easier to discern. The killed were mostly struck by bullets in two or three places.

The guns were fired by cool, experienced men, the late Captain Lendy and Lieutenant Llewellyn (late R.N.) were the firers of two of them.

To this point I attach great importance, the firer must be an intelligent and steady man, who knows how to handle his weapon, and what to do if it jams, and the best means of preventing this casualty. Such a man is well worth a shield to protect him.

Lieutenant Llewellyn's gun was driven in a carriage drawn by four mules. Captain Lendy's gun was carried on horseback; he brought his gun into action in 60 seconds.

In the Victoria Column the machine-guns were on carts drawn by six horses, and with drivers.

A pack saddle for bush work proved a tremendous saving.

I have here a letter from an officer who took part in the Matabili campaign, extracts of which may be of interest:—

"With regard to the Maxims, I am perfectly certain that the best

method of carrying them is on galloping carriages with a tripod in the net behind, so that they can be moved to any point *at once*.

"Even with infantry, I should have them on galloping carriages; they are on a higher level, and command a greater frontal fire, and can be brought to any point *at once*, and they could be left on an eminence to fire over the heads of advancing infantry, and *then* brought up again at a gallop.

"You should, I think, have two Maxims on a given face, so that there is no cessation of fire whilst belts are being changed or from other causes.

"They can be used up to a very long range, and were used by us up to 2,000 yds. with deadly effect upon natives retreating along the sky-line, the distance being found by firing two single shells from a 7-pr.

"They are equally deadly at close quarters, and did *great* execution at 400 and 500 yds., and even closer, on any body of natives attempting to mass.

"In fact, it was perfectly *impossible* for them to do so, no matter what bravery they might have shown.

"At the same time you must remember we were also under a hot fire from the enemy.

"I deprecate the large detachment we have in the service; let the men be trained by all means, but three is ample about the gun.

"The gun should be left to the man firing it. Do not let him be harassed by orders. Let him use his own common sense; the gun will be worked better and the men have more confidence.

"We had no one about the guns except three men, and it was extraordinary the way they worked them, ceasing fire when they saw that it had been effectual and turning it on to another point where it was most required.

"Each man was thoroughly up in the mechanism of the gun, and could put it to rights whatever happened.

"We had spare locks and everything ready, but *they never jammed once*.

"We placed the guns a little outside the laager, with a circle of thorn-bush, about 15 ft. broad, round them, so that by slewing round the trail you could flank any side of the laager; it was, in fact, a

square fort with a lunette at each corner.



"The moral effect of the Maxim I consider great, the continuous firing which can be heard above everything, gives the greatest confidence to the men, and you can imagine the effect on troops of a hail of bullets pouring on to them without cessation.

"I think it advisable not to reserve the fire of Maxims until the enemy is at close quarters, but begin at say 1,500 yds.

"The effect would be very striking on advancing troops, especially if you kept the gun working on the traverse. The great thing about them is the continuous stream of bullets.

"Such an amount of lead can be put in during the most rapid advance that it is my own belief not even the best troops in the world could advance against three or four Maxims well served."

I may add that Sir John Willoughby, who was Chief of the Staff, mentions in his despatches that the Maxims did good service at 2,000 yds., and I have it on the authority of the High Commissioner, Sir Henry Loch, that they would never have been able to keep the Matabili at a distance without the Maxim guns.

Mr. Selous, who has just returned, bears witness, also, to the immense utility of the cavalry machine-guns in Matabililand.

III. MATÉRIEL.

A. *Transport.*

Having followed the gun in manœuvres and in action, let us now turn our attention to the vexed questions of matériel and personnel, upon which such varied opinions are held, avoiding, with your permission, uninteresting mechanical details.

From experience at the above manœuvres and elsewhere, I am led to certain conclusions which I will, with all due deference, put before you.

Transport of the Gun.—In the paper read in this theatre by Captain Benson, R.A., in November, 1887, and in that read at Aldershot by Captain Stone, R.A., in July, 1888, and in the discussions which followed, this subject was well threshed out; but, although five years have elapsed since then, very little has been practically done towards the solution of the question, which I maintain can only be solved by practice in the field. Personally I would like to see experiments tried with a four-wheeled buggy on hickory wheels, somewhat of the buckboard type. It is important to keep the carriage from being top-heavy, and I should mount the gun with a small shield to protect the firer close to the rear axle, so that it could be fired with the least possible vibration, with the horses in, if necessary, though they should be taken out whenever it is safe to do so; but in cavalry work this can seldom be done, for though it takes but a few seconds to take them out or put them in, it is the seconds that make all the difference.

While on this subject I would like to point out a carriage designed by the Maxim-Nordenfelt Company for a 3-lb. Q.F. gun firing 15 aimed shots a minute.

The horses to be driven three abreast like the Russian troika.

I cannot here enter into the question of quick-firing guns with cavalry, it is beyond the sphere of this lecture, but I think that I may safely say that these are the weapons most to be dreaded by machine guns on service.

I have here two cartridges—common shell and shrapnel—designed for the 3-lb., and carrying 45 bullets, case shot containing 108 bullets, but I think a larger calibre, such as a 6-lb., would be far preferable.

But to return to our subject, I must say that from personal ex-

perience I have great respect for a cart of the buckboard type, having been taken over places in them, in the Australian bush, that I had deemed quite impassable; and I expect that there are many officers here who, having travelled in America and Australia and elsewhere, know how much can be done over rough country, in a four-wheeled buggy heavily laden, and not always with the best broken horses. At the same time it must be remembered that wheels will not go everywhere, and I am strongly in favour of having a pack saddle and tripod handy in case of need.

The Cape Mounted Rifles have adopted this suggestion, and a pack saddle is to accompany every Maxim.

The saddle they have adopted is Captain Newburgh Stewart's, which is fashioned with a hinged tree, somewhat on a similar principle to the Austrian saddle, which has come as a blessing to cavalry, and was introduced into this country by General Keith Fraser.

Another saddle which appears to me well suited to the purpose is that invented by General Bogle; it has the great advantage of counteracting the dead weight of the load by means of a kind of cradle and four springs, the weight being distributed over the whole horse's back, instead of having all the pressure on the top.

I have seen a horse with Gardiner gun tripod and 300 rounds of ammunition jump 4 ft. high in this saddle, and it takes but 10 seconds to come into action and about 20 to replace the gun on horse-back.

It is adapted for carrying ammunition and other baggage as well.

Through the courtesy of the above-named gentlemen, both these saddles are here for your inspection.

At least one ammunition horse would, of course, accompany every pack saddle gun with a load of 2,000 rounds.

Light entrenching tools should always be carried with the gun, whether on horseback or on wheels; a few strokes with axe or spade will often enable the carriage to cross an obstacle that otherwise would be impossible, and a hasty entrenchment might sometimes be of use.

As regards harness, I believe that we might get some useful hints from the fire brigades of different countries, but the harness invented by Major Baden-Powell, and adopted by the Government, enables the horses to be taken out or put into the carriage in 10 seconds, and this will be hard to beat.

B. Ammunition.

It is laid down that the Maxim gun should carry 3,500 rounds M.H. bore on the carriage, and 7,200 in the ammunition cart; the whole amount should, of course, be carried in belts, while the Nordenfelt carries 2,000 in boxes. The introduction of the 0.303 bore will enable us to carry about half as much again.

With machine guns it is of the utmost moment that reserve ammunition should be forthcoming when required. The expenditure is so enormous and so rapid that unless fresh supplies are at hand the

guns may find themselves out of action at the very time when they are most required.

The amount of ammunition to be expended during the fight is a matter for careful judgment and anxious thought.

It can only be solved in the field; and no amount of theory will avail, unless the gun commander can keep his wits about him and his reserve ammunition at hand. The amount of ammunition laid down for practice is quite inadequate. An annual allowance of 200 ball and 300 blank for a gun that can fire 600 shots a minute, does not admit of a fair training for either men or horses.

Smokeless powder, so long as it is satisfactory and does not destroy the barrel, is all in favour of machine guns.

We will see our target without being blinded with smoke or our position being revealed by that cause.

The cordite 0.303 bore has not so far proved satisfactory in the Maxim gun, but the powders used abroad appear to answer, and I look on the remedy of these defects as only a matter of time.

C. Range.

This is a most important subject, and one to be thoroughly considered.

At 1,000 yds. it is possible to put nearly every shot on a 12-ft. target, the average being 90 hits out of 100 shots on a 6 x 8-ft. target.

At the same target at 2,000 yds. the average is 15 per cent., but even this would admit of some 100 hits a minute, and at a squadron 9 ft. high by 50 wide the percentage would be much greater.

At 1,800 to 2,000 yds. the Maxim did good service in Mashonaland, and proved itself effective beyond that range.

At distances within 1,000 yds., in the hands of expert and steady marksmen, it is deadly.

Of course, at long ranges, it will be a question whether the execution done will pay for ammunition spent.

Experiments have been made by Major East firing at a particular spot from the reverse slope of a hill. A couple of pegs in line on the brow, and a man with a telescope to signal the result of shots, being all that is necessary to carry this out in a rough and ready fashion.

A bridge or defile where the ground was favourable might be held by an unseen gun in this manner.

A range-finder should always be carried with the gun.

The Mekometre, though requiring two observers I believe, can determine ranges with only 5 yds. error up to 3,000 yds.

D. Sights.

I advocate the introduction of orthoptic sights such as have been adopted by Major East, 1st V.B. Hants Regiment, made by Messrs. Rigby, I believe, and proving most satisfactory.

Telescopic sights might also be carried with advantage.

E. Shield.

The shield should be as light as possible, but big enough to cover the firer and strong enough to withstand the heaviest small arm bullet.

A steel shield of $\frac{3}{8}$ -in. thickness will answer this purpose.

There is no doubt that the average man will shoot better when he is safe, or thinks that he is safe, than when exposed, and a gun with a shield could do a lot of work under fire where an unprotected gun could not live.

Against this, of course, comes the question of weight and whether the advantage of a shield compensates for the extra strain on the horses. Myself, I think it does.

The officers who worked the Maxim in Mashonaland are all in favour of shields.

IV. PERSONNEL.

a. Gun Detachment.

Many are in favour of forming machine-gun detachments into separate units.

How far this might answer I cannot say, but at present the regimental system is far more likely to be adopted because it is the most economical.

It is very improbable just now that money will be diverted from other military objects, to establish machine-gun batteries or troops.

For the present, then, I confine myself to the regimental system, which I think can work very well.

I should like to see three or four machine-guns at least to each cavalry brigade. An officer, a sergeant, and two men to each gun.

An experienced N.C.O. and two men with the spare ammunition, which should be carried in a similar manner to the gun.

Scouts should be permanently told off, both for the gun and spare ammunition.

When several guns accompany a brigade, an officer should be told off in charge of them, lest they should all be on one flank and in each other's way, but a wide latitude as to movements and position must always be conceded to individual gun commanders.

β. Scouts.

And now we come to a subject that has not been touched upon so far as I can learn in previous discussions. I refer to scouts.

As with cavalry so with machine guns, the great chance of success is in surprise, and the chief risk of failure lies in being surprised. It is therefore of the utmost importance to have good scouts, four at least for each gun and two for each ammunition cart.

Cavalry leaders are naturally adverse to weakening their squadrons, but I ask you, is it not worth while to take a man out of the rear rank of each squadron, rather than to cripple the whole offensive advan-

tage of a weapon which, if properly handled, may decimate a whole brigade?

Though it would be folly to gallop blindly forward, in an unknown country, without scouts, for ground or enemy, it is by pushing forward, not foolishly but boldly, that the gun will make its name.

7. *Escort.*

Except under certain conditions an escort is a great advantage. It makes a man bold; the knowledge that it will follow and look after the detachment takes away half the anxiety of the machine-gun commander.

Without an escort he has to be ever looking round.

Where is the main body?

What is their object?

How can we get there?

Shall we be in the way?

are questions that constantly crop up, and though, of course, they must be borne in mind, they should not be allowed to bar the road to enterprise, and a field troop, as escort, would solve the question.

Again, the presence of a troop will tend to keep the enemy's cavalry from scattering, and so offer a better target to the gun; this would also apply to infantry, besides preventing the risk of capture from single horsemen galloping in from opposite directions.

On occasions, when the escort is not required, it could rejoin its squadron.

V. FOREIGN PROGRESS.

The following notes I have obtained from foreign military journals:—

In Switzerland there is to be a Mitrailleuse section incorporated in each cavalry regiment consisting of—

- | | |
|----------------------|--------------------|
| 1 officer, | } to 3 Maxim guns; |
| 1 sergeant, | |
| 1 armourer sergeant, | |
| 3 corporals, | |
| 12 men, | |

12 men,

2 drivers,

4 horses to draw the ammunition wagon on which the guns are

carried on the march;

19 riding horses;

6 pack-saddle horses, *i.e.*, 3 for the guns and 3 for the ammunition, the latter carrying 2,000 rounds apiece.

These pack-horses are led by mounted men, who have a stick instead of a leading-rein to prevent their knees being crushed by ammunition boxes or gun.

They are never to be used singly but to support one another.

Before taking the field the gun commander will obtain his chief's instructions, and will conform to the best of his ability.

The gun detachment will, as a rule, follow in the rear of the regiment, but in the attack will take up a position in rear that the cavalry, if beaten, may rally round them. (While we examine these tactics we must remember the mountainous nature of the country.)

These guns will be most useful in enabling cavalry to hold an extensive line of front along a river or mountain range, a few machine guns being placed at the points of passage accompanied by weak cavalry detachments quite independent of the remainder of the cavalry.

At night machine-guns will be allotted to outposts and pickets.

My authority proceeds to say that no cavalry leader is to be influenced by the machine-guns, nor is a single trooper's life to be sacrificed for them.

They are to be looked upon only as a welcome auxiliary to cavalry, never as the principal arm.

Whenever it is necessary, in order to rescue troops, the machine guns are to be sacrificed.

The moment that cavalry has to cover machine-guns it ceases to be cavalry.

There are 24 Mitrailleuses or Maxims required for the Swiss cavalry, and 8 wagons.

The Maxim is carried with the tripod on one horse and 2,000 rounds on another, its calibre is 7.5 m.m. or 0.295 bore.

8,000 rounds are carried in the wagon for every gun.

10,000*l.* has been voted for this purpose, 4,000*l.* of which is to be spent this year.

The Austrians, though they have not as yet adopted machine guns for field service, admit the necessity of supporting cavalry regiments with infantry fire, since in their last manœuvres, 1893, they attached two battalions of rifles to each cavalry division, which, in spite of brilliant marching, necessitated to some degree the subordination of the movements of the cavalry to the riflemen.

I may mention that one battalion marched 67 miles in two days, and only 11 men fell out.

VI. CONCLUSION.

In all the above suggestions I would ask you to bear in mind that I claim nothing for theory; practice and experience are alone the true and proper tests, and unless experiments are made all argument is in vain.

To sum up the whole matter, whether the gun is carried on horseback or on wheels, whether the detachments belong to regiments or are a unit of themselves, the same tactics will apply, and rapidity of movement is the great desideratum.

Tell the gun commander the general idea, give him as free a hand as possible, and I predict that these guns, so far from being an impediment, will be a welcome aid to cavalry. They are suitable alike for attack and defence, a useful auxiliary to every arm, and will prove themselves of value hitherto undreamt of.

As the improvement in modern firearms continues, so does the importance of supporting our cavalry with fire increase.

Here is a chance of carrying, so to speak, a battalion in our pocket.

We have proved that it can travel, we know that it can shoot. It is but a few weeks ago that it saved a British column from defeat. One of the enemy has described its effect. In his own words he says, "It mowed us down." What is there to prevent these ominous words from being applied to the battles of the future?

Major BEAUCHAMP, 20th Hussars: We have listened with great interest to the advantages of machine-guns with cavalry, but I would ask cavalrymen to be careful in accepting machine-guns as part of their equipment too hastily. I am touching a delicate point when I refer to mounted infantry, but I think that arguments have been raised against the present system, by officers commanding battalions, because their best men are taken from the battalion. The Cavalry Regulations lay down that 50 men per cavalry regiment should be trained for machine-guns. As a cavalryman I would like to see the all-important duty of scouting practised and perfected (if possible), which would be a considerable gain to our cavalry. Our gallant lecturer enumerates the difficulties of the officer commanding the gun detachment, by the circumstances he has to consider—without scouts—viz., Where is the main body? What is their object? How can we get there? Shall we be in the way? Those are the anxieties of the officer commanding the machine-gun. Those advocating the machine-gun worked by cavalrymen must not forget that the anxieties of the brigadier are as enumerated above with innumerable additions, and would not these anxieties be lessened if he was aware that there were in the ranks of the regiment 50 good men trained to scouting and how to report, than that he had 50 men in each regiment trained to the use of the machine-gun? I am an advocate for, and do not wish to say a word against machine-guns working with cavalry, provided they are worked by proper men and remain in their proper places. Let us follow the Idstone Manœuvres. Captain Anstruther Thomson is alive to tell us the whole story of the extraordinary deeds he performed, and there is no doubt that great deeds can be performed by machine-guns if opportunities occur. The all-important point is find the opportunities. I think on several occasions the machine-guns would have been captured or disabled had it been reality. During the manœuvres I observed that we did not play the game with machine-guns, because, for my part, they seemed too insignificant, and I do not think anyone really knows how many or how few men are required to capture an unsupported machine-gun. Our lecturer refers to a Nordenfelt having been captured by two or three detached men, I think the Maxim might have been captured in the same manner on several occasions.

Colonel DICKSON: It never was.

Major BEAUCHAMP: That is quite true, because we were doing peace manœuvres, but we will fight together and not against one another in war. The lecturer talks of the amount of damage done with his gun, citing instances of catching cavalry asleep, or unprotected; as I said before, we want more cavalry training proper before we can go in for machine-gun training. Had there been proper scouting the gun should never have been allowed to get so near. Captain Anstruther Thomson frequently urged his lack of good scouts, and appealed for escorts at times. Can we spare men for such duties when attacking an enemy? He also quotes the incident on the road through Andover Park, when he applied for an escort of a field troop, he got two squadrons. Were the two squadrons sent to support him, or was he sent to support the two squadrons? If the latter, the machine-gun was assisting cavalry in carrying out its functions as cavalry proper. Would it not be better if, instead of dashing about on an independent duty, the machine-gun remained in a position where the brigadier could send for it and send it to the most deadly position, which position through the information gained by scouting, &c., should be known to the brigadier better than anyone else? Eventually we find

Captain Thomson leaving the cavalry in his independent rôle, and mixing with the infantry and mounted infantry, which is the right place for the machine-gun. Perhaps there are not many who will back me up on that point. Have we any experience of the effect of machine-guns on moving targets? We have heard a great deal of the deadly effect of machine-guns on stationary or slow moving masses, but on rapidly moving targets it would be different. What damage would a machine-gun inflict on a charging regiment of cavalry in front of it, especially if the target had an element of danger to the firer. Captain Anstruther Thomson claims to have destroyed a whole battery of artillery at one time, which is rather rough on the artillery; and at another time he mentions the destruction of a whole brigade of cavalry with his gun. If a machine-gun is really so deadly, so destructive, have them everywhere, and manned by the best men to be found anywhere. I would like to raise the question whether the machine-gun if used with cavalry and worked by cavalry, is in its proper place, viz., "in the front line," when cavalry are charging. Also whether the time expended in training men as machine-gunners would not be better spent working with their own regiments learning the innumerable duties of cavalry proper.

Captain EAST: I know nothing about cavalry whatever, but I have had a little experience with the Maxim gun, not with the cavalry carriage but with the infantry carriage, and there are some few words I might say. With regard to the question of moving targets, I have shot at a moving target. We fired at a barrel going along with an 8-knot current at an unknown range off Warden Point. The D.R.F. was to give the ranges. At the beginning I said "Let us see if the gun cannot find the range for itself." The result was I found we could pick up the range with the gun quite as fast as the range finder could give it to us, the ranges being between 1,100 and 1,400 yds. It is the simplest thing in the world to hit a moving target; you have only to lay your gun well in front of it, and then the target goes through the stream of bullets. There is no question about making good shots, and judging so many degrees of right or left deflection; you simply get the stream of bullets in front, let the gun run, and your target has to go through it. You cannot miss; it is almost impossible in that way, provided you can see where your bullets strike. That is the one thing about this gun, and the one great advantage, I take it, that this Maxim has over all other guns that I have seen, that it makes such a close pattern, to use a sporting gun phrase; and you really can see the strike of the bullets at ranges where you cannot see either a single bullet or recognise the ground beaten by controlled fire, that is, volleys. Say at 1,000 yds., 50 per cent. of your volley will be in a space 100 yds. long by 10 yds. wide, the whole volley will cover 200 yds. long, but the bullets from the Maxim at 1,000 yds. will be within 8 ft. in breadth and 27 yds. in length; you will see them easily dropping in as they do at the rate of over 600 a minute, 11 a second. It very much depends upon the state of the ground and the state of the atmosphere, but you have a very much better chance with that weapon of seeing where your bullets fall, and you can regulate your fire by that. You do not want to take a fresh sight. The look-out man will say, "You are a little too low or too high," and you get your elevation in that way. With regard to indirect firing, I rather expected to hear some one say it cannot be done. I only tried it on one occasion; I tried two experiments, Colonel Hale saw what happened, and the amount of time it took to get the range. I did not use at that time any instrument for the purpose of getting the range or the vertical elevation. It was simply a case of tipping the bullets over the crest of the hill, and seeing where they were falling. I was watching the fire; it began low, and I waved my handkerchief up until they got on the target. It was a very simple matter. Then I may mention the question of mounting, I am convinced that the mountings of this gun should be made as light as possible. I went to the manoeuvres, of which we have heard, and looked on a good deal; in fact, I was really hunting the machine-guns all the time, but I was trying to study the infantry not the cavalry gun. As a matter of fact, I ultimately found myself hunting the cavalry guns for this reason: the weight of mounting of the infantry gun was such that on those contours that we had at Idstone the infantry gun could not get up at all; it was always in the rear. The Nordenfolt gun carriage weighs 10 cwt., and the service Maxim gun 9 cwt. If you come to a big hedge you cannot

get these heavy carriages over, and we got some places where the slopes were one in four and one in three, there they simply could not get up at all. Then again the service carriage is loaded up with 4,000 rounds of ammunition. It appears to me you want a very much lighter load. No doubt we should like to have 4,000 rounds with us on the gun, and we should like to have 10,000, but we had better get with 2,000 rounds where we can use it, and trust to more ammunition coming up before we have run out, than not get into action at all. I attended the manoeuvres near Petersfield with the infantry carriage that I have carrying 3,000 rounds, and there the whole weight is 11 cwt. It is a little miniature limber and gun carriage, but it splits into two parts of 5 and 6 cwt. respectively, and there is all the difference in the world between getting one of 5 and one of 6 cwt. over a hedge and getting 10 cwt. over in one lump. You cannot get the 10 cwt. on the one pair of wheels over at all. On one occasion I got into a wood, and we had either to go through or round; with my little light carriage and 12 men I scrambled through the wood and got to the other side, and I had some very good fun afterwards. The Nordenfolt that was with me, and started from the same place in the wood, never came into action for 45 minutes after I left it. It came in just as the cease fire sounded. It was so heavy that it had to go back, down the road, and all round the wood, it could not possibly get through. I am glad that Captain Thomson has mentioned the tripod. It is absolutely necessary, whatever kind of mounting you are on, to carry a tripod. Of course it does not so much apply to cavalry, but even cavalry will occasionally find themselves where they will want to do a little village defence, and then the tripod comes in. You can get it anywhere you like, up a church tower, and in all sorts of places where no wheeled carriage could go by any possibility. It only weighs 47 lbs., and it is a most important thing to have. From my little experience I must thoroughly concur with Captain Thomson in everything that he has said, and really most of the remarks made with regard to cavalry guns would apply, with but slight modification, to the infantry working of these guns as well.¹

Major G. STONE: The lecturer has so accurately expressed my own views on the subject that I have very little to say. He has alluded to the formation or organization of machine-gun sections regimentally, that is to say, in connection with the regiment or battalion as opposed to the system which some have advocated of making them into batteries or troops, or whatever you like to call them, in fact, making them independent units. I think the conditions now are somewhat changed to what they were four or five years ago. Four or five years ago the machine-gun was essentially nobody's child, and as we are a very conservative nation, we naturally look very suspiciously at any new weapon. Four or five years ago the machine-gun was not likely to get used to much advantage so long as it was attached to regiments of infantry or cavalry, for the simple reason that the commander of a cavalry regiment would, as Major Beauchamp has already said, look somewhat jealously at it, saying that his best men were being taken to manipulate the guns, and so on. Possibly a similar feeling might exist in infantry. For this reason I think the views expressed some years ago as to the advisability of forcing the machine-gun sections into separate units were very sound, but since the subject has been more warmly taken up by many officers, the lecturer, and others, who have gone into it very keenly, judging not by theory but by practical proof of what the gun can do when properly handled by men who understand its practical working; the conditions, I think, have been rather changed, and I am inclined to give up the view I once held, and think perhaps it is better that the

¹ The infantry gun equipment I use and advocate consists of gun on field carriage, with shield carrying 1,000 rounds. Ammunition, weight 5 cwt. Limber drawn by cob carrying 2,000 rounds, rifles, tools, &c., and to which the gun carriage is limbered up on the line of route, weight 6 cwt. Ammunition cart drawn by horse, carrying tripod, entrenching tools, forage, &c., and 7,000 rounds ammunition, with limber hook in rear, to which gun carriage can hook on if necessary. Total weight 12 cwt. Special arrangements are made for conveyance of ammunition from one to the other by hand in action.

gun should remain part and parcel of the regiment or battalion. Then, with regard to another point, the lecturer says he thinks we should have at least three or four guns with each cavalry brigade. Our field force for service abroad, by which I mean the special field force to be employed in our colonial expeditions, includes a cavalry brigade with one regiment having a machine-gun section as well as a company of mounted infantry having also one machine-gun section. I am not including the infantry machine-gun section, as that belongs to the infantry division. I think this proportion is very small, and as it is clear that the authorities who were responsible for drawing up the organization of our field force must have felt at the time that they required to treat it in a somewhat exceptional manner as regards the cavalry brigade, in view of the fact that two batteries of horse artillery instead of one have been allotted to it, I think that further experience of what the machine-gun can do with cavalry might lead them to see the advantage of having perhaps one machine-gun section with each cavalry regiment, that is, three sections for a brigade, these to be brigaded together when necessary in the same way as the regiments themselves, sometimes with the whole brigade and sometimes separately. This suggestion refers only to the organization of the cavalry brigade allotted to the field force for service abroad.¹

Colonel J. B. B. DICKSON: I had no intention of saying anything this afternoon, because I agree with almost everything the lecturer has said. On one point I do not agree. He says he would like to have an escort. Well, every little party you send out would like to have an escort—everybody wants an escort. I have had a little experience on different occasions with cavalry brigades and cavalry regiments, and my opinion is that you should send out as few and as good scouts as possible; escorts should be very seldom given, even to horse artillery. Of course, when you send batteries away to some distance they must have an escort, but, as a rule, the nearest body of cavalry to where the battery or machine-gun is placed is generally a sufficient protection. Major Beauchamp made an observation to the effect that he was prejudiced against machine-guns for cavalry, for the very natural reason that he does not like parting with his men; but he seems under the impression that it is necessary to have 50 men. I think five men is the limit.

Captain THOMSON: Three men I ask for.

Colonel DICKSON: And scouts. I should give the three men, and I should give possibly five men, but certainly not more than that. The gun commander would have to make the best of the five men. I should also be rather afraid of his scouting too much. I should like to see the guns near the brigade, and all the scouting done by the brigade. I think, of course, the machine-guns should have a perfectly free hand, so as to help the cavalry as much as possible, but that the cavalry should not subordinate itself to the guns. Reference has been made to the two squadrons that went to the lecturer's assistance when he applied, I think it was for a field troop as escort. During the manœuvres quoted I think this was the only occasion when two squadrons acted of their own accord. As I had frequently said, "Never mind individual squadrons, but leave them alone; we want to act as a brigade." They, however, saw what they thought a good opportunity, but which, I am sorry to say, turned out unfortunately for them.

Colonel LONSDALE HALE: The Council, at my suggestion, wrote to all the commanding officers of cavalry regiments who had been engaged in these manœuvres, in the hope that some of them or their officers would come and take part in this discussion. According to the lecturer and military historian of Colonel Dickson's cavalry brigade at these manœuvres, Colonel Dickson's machine-gun carried everything before it, and so far as I saw it, it did so. But there are always two sides to a question, and it would have been well to have had the opinion of Colonel Wardrop

¹ The experience of the majority of our small wars tends to show that in many cases there should be an unusual proportion of cavalry, mounted infantry, and mounted machine-gun sections. The Boer War is, perhaps, the most striking instance of the unsuitability of infantry for the operations which had to be undertaken.

as to what the other brigade thought about the effect produced by the hostile machine-gun. I was rather surprised at some of the remarks that fell from Major Beauchamp. The lecturer did not exactly claim that that cavalry brigade were swept away on the convoy day. I should like to have asked Colonel Wardrop how was it that he went in front of this machine-gun at 800 yds. and took no notice of it at all? As that brigade acted, they must absolutely have suffered most enormous loss, as Major Beauchamp says you do not look after it. There is this little machine-gun, a sort of cavalry flea, hopping about from one place to another, as Captain Thomson did make it hop about most admirably during the whole of the manoeuvres. It was here, there, and everywhere, and gone before you could catch it. That is just the point of the machine-gun. Of that cavalry squadron that the gun caught 200 yds. away, Major Beauchamp says that if the scouting had been properly done, it would not have happened, but somehow or other from my recollection of military history, cavalry do not always scout properly.

Major BEAUCHAMP: Not our cavalry.

Colonel LONSDALE HALE: You do catch cavalry not scouting, and as regards opportunities, the opportunities for the use of machine-guns will be simply innumerable if manoeuvring is anything like war. With regard to escorts, Colonel Dickson has spoken against them, and, if I were Captain Thomson, I would leave the question of escorts to itself. I am a firm believer in the machine-guns, and I am perfectly certain the first time they are used on service with regiments of cavalry the cavalry commanders will believe in them too, and, rather than sacrifice their machine-guns, if they think the machine-gun is in danger they will give the escort. The escort question will settle itself simply by the experience of war. Major East has referred to me with regard to what took place. Major East is unknown, perhaps, to some gentlemen here present, and I may say he has a private range of his own, and a private Maxim gun. He kindly invited me to his home, and I went down under the impression that a machine-gun was a weapon which was constantly jamming and liable to get useless. He showed me the mechanism of the gun, and the jamming, I am informed, happens because when the machine-guns are issued to our troops it is forbidden to allow the barrel to be removed from the water casing; the regiments are never allowed to do that. The consequence is, the glands on which the barrel works get stiff and hard, and after they are kept six months in store the gun jams. Major East laughed at the idea of the gun ever jamming. He took the barrel out in my presence, and in about 10 minutes put it back again. The failures of the gun which occur at manoeuvres arise from the gun not being properly taken care of, and the men in charge not being properly instructed in it. I can corroborate what Major East says about firing at unseen objects. You can get behind a hill, and, as he says, and as I saw, you render the bridge almost untenable by this flea hopping about, and pouring this stream of bullets upon the bridge.

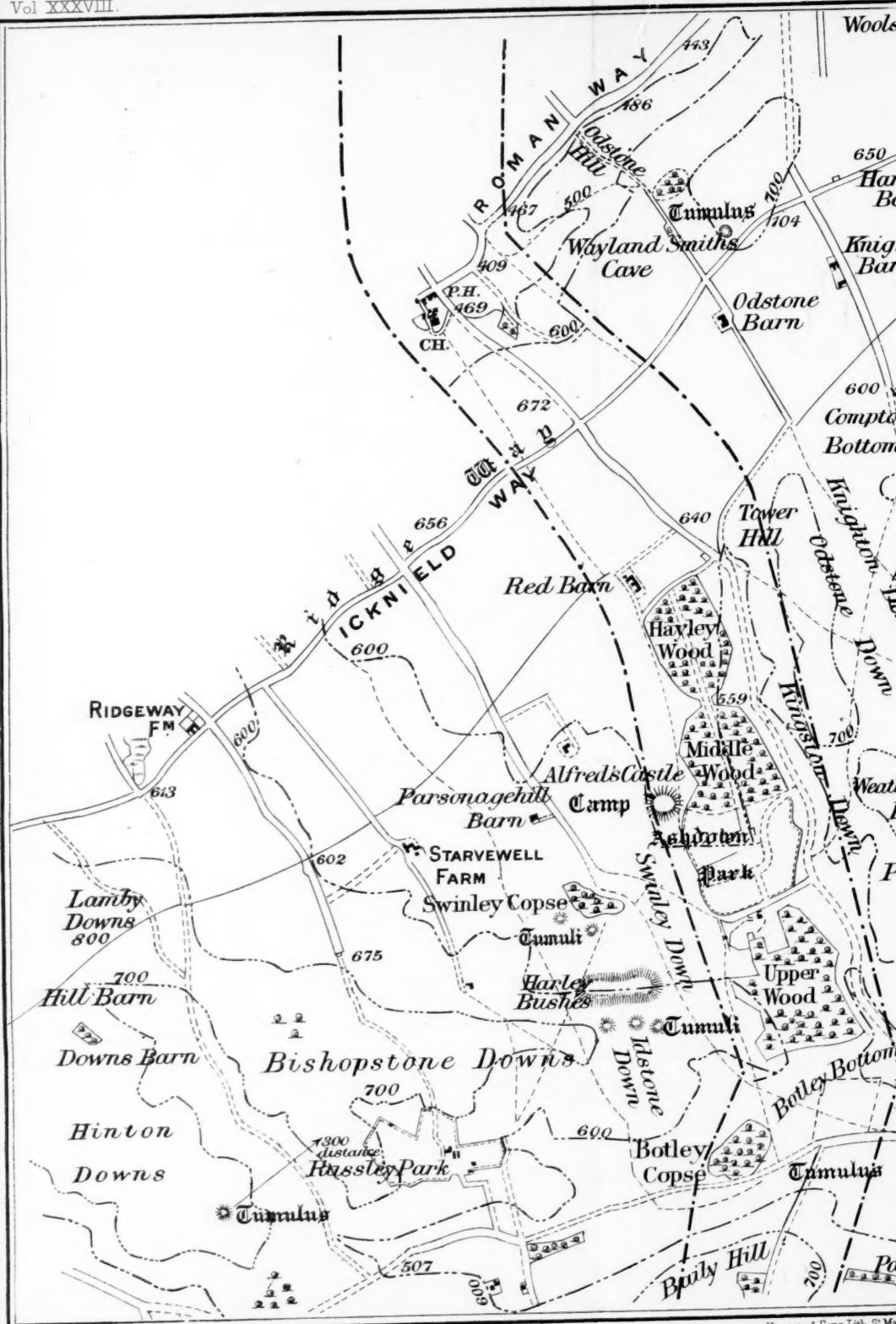
Captain ANSTRUTHER THOMSON (in reply): I think almost all the questions have practically been answered for me. Major Beauchamp speaks of 50 men being trained to the machine-gun as if the 50 men would be taken away from the cavalry work of the regiment. But this was not what I meant. I know in the book it does say that five officers and 50 men should be trained. I think that is very right, but it does not entail that these 50 men should be taken away from their regiment. Now I only ask for three men to work my gun. I ask for scouts; but the scouting is all-important for cavalry as well as for machine-guns, and scouts may just as well be employed in scouting for a gun as for their own body. With regard to mentioning the capture of the enemy's Nordenfolt, it is a detail, and an insignificant one. I merely mentioned it to point out what can be done if you have not got scouts. As a matter of fact, all the scouts, the escort, or the several men who accompanied the Nordenfolt left it for some reason, and our hussars popped down upon it when it was unprotected and unwatched. With regard to the shooting of the brigade at 800 yds. at a walk, I only mentioned it as an instance of what possibly, most improbably no doubt, might happen in war. I take no credit for what the Maxim did. There happened to be opportunities, and I made the most of them as best I might. I have no doubt, if a brigade was within 800 yds. of a gun properly served at a walk, it would be annihilated. Major Stone, I think,

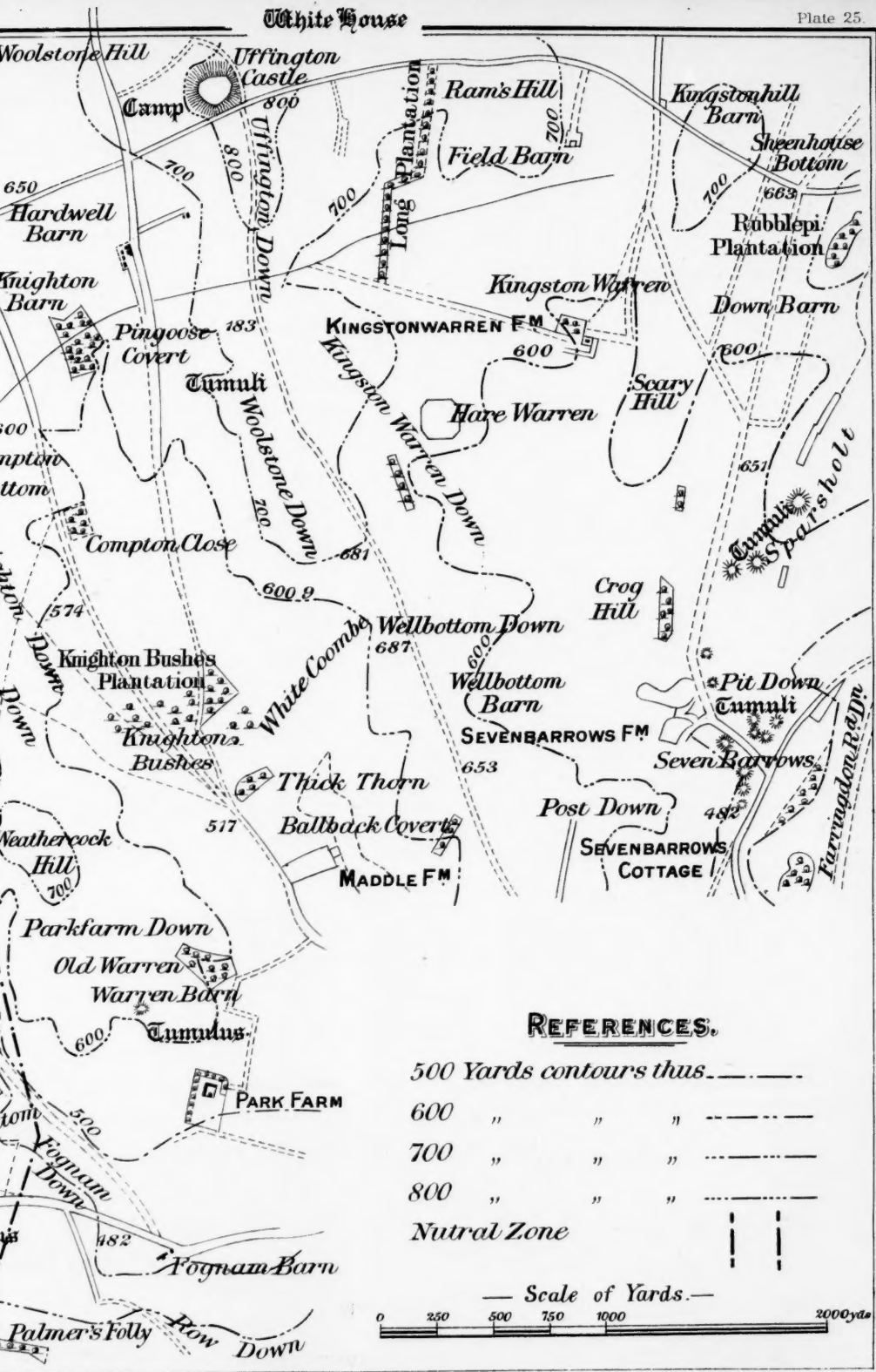
requires no answer, as he agrees with me. With regard to Colonel Dickson, of course, I take the view of the man with the gun; Colonel Dickson takes the view of the brigadier, and, of course, I bow to his view. With regard to Colonel Hale, I now know that it was very wicked of me to leave the cavalry, and I offered an apology for it you will notice. The fact was, I was enticed from one position to another hotly engaged with the enemy. There were cavalry in front of me. I did not know where the rest of the enemy's cavalry were. I thought I had them in front of me the whole time, and I left my own body of cavalry at a halt doing nothing. I saw opportunities of cover, and I took them. At any rate, the important thing to my mind was to win the victory, and I believe we did so.

The CHAIRMAN (Lieutenant-General J. Keith Fraser): Gentlemen, before asking you to give a vote of thanks to the lecturer I would like to make a few remarks on what he has told us and on what some other officers have said. In the first place, we have to thank very much gentlemen who have taken part in the discussion, some of whom do not belong to the cavalry. I think Major East's observations are of great value to us as coming from a man who has tested the working of machine-guns so thoroughly. I am in a neutral position with regard to the last manœuvres, because, although I commanded the cavalry division, the brigades were separated, and therefore I looked on almost as a spectator, and I am not so biased in favour of one side or the other as naturally people who take part are. From all I saw of the way the gun was worked, both in 1890 and 1893, I can only say that if I went on service with a brigade or division there is nobody I should like to have in charge of machine-guns better than our lecturer. Everybody who saw him shared my opinion; he was always in the right place, and worked the gun wonderfully. As a cavalry officer, I am greatly in favour of machine-guns accompanying the cavalry, and I have the greatest possible opinion of their future. I think the rapidity with which they can come into action is the main point. Of course, we should all like to have the horse artillery guns up, but that is impossible, even with lighter guns than we have now. Machine-guns ought to go as fast as cavalry, and they should have carriages which will get over every spot of ground with equal rapidity as the cavalry. I am afraid I differ with the lecturer on one or two points. Colonel Dickson has done so also, and I must say I agree thoroughly with Colonel Dickson, from the cavalry commander's point of view; and not as Captain Thomson looks upon it, viz., from the point of view of the officer in charge of the guns. I do not think they ought to be independent of cavalry. We have enough branches of the Service already, if not too many; the less of them the better. We had better stick to our old cavalry, infantry, and guns. If we have these independent specialist branches I am always afraid of their not being at the right moment where we want them. I think the great thing is to have the machine-guns sticking to their regiments and brigades as near as they can. Horse artillery has to go a long way off to take up advanced positions or to go to the flank; it has to go right away, but the machine-gun should stay with the cavalry, ready to take part at once in the action if the cavalry are advancing to attack.¹ With regard to the attack on the artillery which the lecturer spoke of. It would be effective, no doubt, as long as there are a good many men about the guns loading and firing; but I fancy at some future day we shall have Q.F. guns, where the men will be behind the gun—one man on the trail, another man firing—two men or three men, and they would be well covered by the gun, and also, I suppose, by shields from musketry fire. I doubt, therefore, whether the machine-guns would have very much effect upon artillery. I think the danger to artillery is cavalry; I would rather attack artillery with cavalry than with the machine-gun. With regard to infantry and cavalry, we know from what we heard in the late war the effect has been something marvellous. This morning I saw the original of a letter that appeared in the "Pall Mall Gazette" of last night from Captain Lendy as to the effects of the gun, in which he described its terrible effects, and stated that the Matabele said that they would "fight us again if we left our Maxims at home." I think there is no doubt, both

¹ The machine-gun fire would have the same effect as case-shot, and would relieve the artillery from the necessity of making use of the latter.

against cavalry and infantry, its effects will be most marvellous as a weapon of offence, but the cavalry will have the advantage of being able to move out of its fire very quickly. I must say a word about Captain Lendy. I daresay a good many of us know Captain Lendy's father, and I think we all must have heard with the greatest regret of the death of his two gallant sons, one in West Africa and one in East Africa, who both died by unfortunate accidents, both being most distinguished men who had already made their mark. As to escort and scouts, the demand is much too often made for an escort, or to send some more scouts. If you only knew how weak our cavalry is on all occasions, how weak our squadrons are for foreign service! A squadron in England is only two-thirds the strength of any squadron in Europe. I know it is a great compliment to us, and I have no doubt the people who framed that Regulation meant it as a great compliment to Englishmen, but if you begin to take away escorts and scouts and all these kind of things when foreign armies are provided with separate sections, troops, and half squadrons for this purpose we shall be in great difficulty. Every regiment abroad has a quarter of the squadron used for this purpose, and kept separate. If we have to take them from the ranks you will come down to having nobody at all with your squadron. If you send a troop here and a troop there you end by having nothing, and we cannot afford that. I am all for sending out as few scouts as possible. I am sure a few scouts are of much more service than many scouts—you cannot have too few. I think the guns remaining near the cavalry, and trusting to the cavalry scouts do not want any special scouts. Of course, if you send them away you must have one or two. If there are only three men with a gun possibly you can send a scout or two, but otherwise there should be no escorts and no scouts. I had a letter from Major Baden-Powell, whose name has been here mentioned. I think most of the points he makes have been already raised, but he has taken great interest in the machine-guns, in harnessing the horses, putting three horses abreast, &c., and there are one or two points he wishes me to mention. He thinks there is a habit, from what he has seen, of looking upon the safety of a machine-gun as a matter of honour, and that you must stick to it and not lose it on any account. I think that idea has gone out, even with the horse artillery; they are now quite willing to stand by their guns in action to the last, and lose the guns if necessary. It is not a point of honour now not to lose the gun, but it is a point of honour to do the best you can to the last, and even to lose your gun. He points out, further, that he thinks that machine-guns ought to be as low down as the axle; that a tripod should always be carried; that the gun should be easily detachable to be placed on it. He also thinks the idea that horses can go rapidly over broken ground and every sort of ground drawing 6 cwt. is wrong. He thinks it should be 5 cwt. at the outside, and that 4 cwt. is about what is right. It depends a great deal upon the horses; taking an average 4 cwt. is sufficient, and I fully agree with him. He also says he has heard Mr. Selous attach the greatest possible value to what the machine-gun has done in the late campaign. My own opinion is that what we want for the cavalry are light Q.F. guns, 6-prs. or 9-prs., that can keep up with us and go everywhere, and get into action quickly. At the same time, I am all for having a machine-gun to every regiment of cavalry; I think it would be of the greatest possible value. The lecturer says he would have it on the flank. I would have it behind the centre, or wherever it could get out quickly when it was wanted to the front or either flank. Although there are greater dangers, as everybody sees, to cavalry owing to the improvements in firearms, my own idea is that the improvement will give us also immensely increased power. I think we shall have a great advantage myself over other arms. We can move away from fire, we can make flank movements rapidly, whereas the infantry, when they come under fire, cannot get out of it quickly. I think with these guns our day is getting better and better. I have only now to ask you to give a vote of thanks to the lecturer. I am sure we are all greatly obliged to him, and I think the number of officers present shows the interest that is taken in this subject.





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Friday, March 2, 1894.

MR. LENNOX BROWNE in the Chair.

“THE ART OF BREATHING AS APPLIED TO PHYSICAL DEVELOPMENT.”

By A. L. HOPER DIXON, Surgeon-Captain, A.M.S.

MR. CHAIRMAN AND GENTLEMEN,

The purport of my paper is to show the relationship which exists between the correct process of respiration and the physical development of the chest. But prior to discussing this question I must briefly occupy your attention in demonstrating, from an elementary point of view, the anatomical and physiological aspects of the parts concerned.

The trunk of the body consists of two cavities, an upper thoracic—the chest—and a lower abdominal—the belly. The higher chamber contains the lungs, heart, and great blood-vessels, that is the circulatory and respiratory apparatus, and the lower the stomach, liver, kidneys, and intestines, in other words the organs of digestion, nutrition, and elimination. Interposed between these is the diaphragm, which is by a long way the most important muscle concerned in respiration.

This muscle forms a contractile curtain and separates the chest above from the abdomen below.

The chest is conical in shape, narrow and immobile at its upper part, broad and expansile below.

Above, in addition to supporting the neck, it provides passage for the large blood-vessels, the wind-pipe, and gullet. In front, is the upper portion of the breast-bone, laterally the first ribs, and behind is the spine. The middle portion of the chest has the breast-bone in front, ribs on either side, and the back-bone posteriorly. The floor of this cavity is formed by the diaphragm. There are twelve ribs on either side, which, with the breast-bone in front and spine behind, serve to form the bony framework of the chest. These ribs are elastic in action, on account of the cartilage interposed between them and the breast-bone, and are arched in form. Behind they are attached to the back-bone.

The ribs increase in length from the first to the seventh, after this they diminish. The seventh rib would probably be the most mobile

and the first the most immobile. Their direction is oblique, and the interposing spaces are termed "intercostal."

I now come to the diaphragm. This is a muscle whose importance cannot be overestimated.

It forms a floor for the chest, supporting the lungs and heart, and a roof for the abdomen. It is like a dome in shape and undergoes changes in form during respiration, which I will describe later on.

It is attached to the internal circumference of the chest, to the lower portion of the breast-bone in front (ensiform cartilage), to the six or seven lower ribs on the sides, and to the back-bone behind.

So far as the muscles of the chest are concerned it would have no bearing on this paper to discuss them in detail; suffice it to say that the ribs are laced together by two sets of muscles termed "intercostal" which severally play their parts in the process of respiration.

I now come to the physiology of these parts. The lungs are the most important structure and fill up for the most part the cavity of the chest, of which they take the shape, that is, roughly, pyramidal or sugar-loaf, with the narrow portions above and the bases below.

They are united by the wind-pipe which bifurcates a little below the root of the neck.

They consist for the most part of air-cells, with a rich supply of small blood-vessels. The amount of air-cells is calculated as about 725 millions. The right lung is larger than the left on account of the latter having to make room for the heart.

For the sake of analogy the lungs may be compared to two large sponges capable of absorbing atmospheric air, as sponges would water, and then discharging, by virtue of their elasticity, the impure carbonic acid gas. This alternate expansion and filling with pure air, and contraction with emptying of impure air, constitutes the process of "respiration," and the extension to which it is done is termed the vital capacity.

The effects of respiration are twofold:—Firstly, to introduce oxygen, which is necessary for the maintenance of life, and, secondly, to get rid of substances, the products of combustion, which, if allowed to be retained, would poison the system. Inspiration fulfils the first requirement and expiration the second. So far as inspiration is concerned, the enlargement of the chest is entirely muscular, and the diaphragm is the most important muscle which provides for this increase of dimension. Every time we breathe, the diaphragm contracts, has a tendency to become flat, pushes down on the abdominal organs, and thereby elongates the vertical diameter of the chest. The increase in the transverse diameter of the chest is due to rib expansion, and the antero-posterior diameter of the chest is increased by the ribs pushing the breast-bone forward. Expiration, on the other hand, is not a muscular act. For when the inspiratory act is over, everything flies back to its original position. This is due to elastic recoil, aided by the weight of the chest; and at the same time the pressure on the abdominal organs is relieved by the withdrawal of the diaphragm.

So much for the anatomy and physiology. I now pass on to the

pith of my paper, which professes to show how breathing, properly applied, may affect the physical development of the chest.

I have shown how the chest may be increased in three diameters, namely, from above downwards, from before backwards, and sideways, and I now intend to give you a practical demonstration of correct and incorrect methods of taking one's breath. These may be easily observed from the exterior. (1) Upper chest or collar-bone and shoulder breathing, (2) mid-chest or rib breathing, and (3) abdominal or diaphragmatic breathing.

These movement are to some extent dependent on each other.

I will first take the incorrect mode of breathing. This consists in filling the upper and middle portions of the lungs with air partially at the expense of the lower.

I take an inspiration, my collar-bone and shoulders are raised, so also are the upper chest and top of the breast-bone; there is a slight movement upwards and outwards of the ribs, whilst the lower portion of the lungs remain passive. The diaphragm is only exercised to a feeble extent, and the abdomen, released from diaphragmatic pressure, shows a concave surface instead of convex. This mode of breathing is practised by the majority of people, both male and female, when asked to do a respiratory gymnastic, but is never practised during sleep. I have no hesitation in stating it to be entirely wrong. I have already described to you the narrow limits and immobility of the upper portion of the chest, where the lungs in that quarter are imprisoned in a bony, inelastic box, in close apposition to the wind-pipe, gullet, and large arteries and veins, so it is not inconsistent to suppose that this form of breathing must not only exercise undue pressure on the subjacent parts, but also cause imperfect aeration of the blood.

I have frequently seen both amateur and professional singers grow scarlet in the face whilst singing, owing to their employing this upper chest form of breathing and thereby causing congestion of the vessels already referred to.

So far as my experience of the recruit goes, he does the same-thing. He has not the slightest notion of filling his lungs. He is told to take a deep breath and replies by raising his collar-bones and hunching up his shoulders. In other words, he makes an exaggerated effort of his usual mode of breathing.

The result is that his chest expansion must be very small. I have frequently met recruits with less than one inch chest expansion, and some only half an inch.

I now come to the second mode of breathing—mid-chest or rib. This consists in the expansion of the middle and lower portions of the chest, principally in the transverse and antero-posterior diameters, which is accomplished through the medium of the ribs. The latter are drawn forwards, outwards, and slightly upwards, and the breast-bone is pushed forwards. This mode of breathing does not stand out separately by itself as an independent act, but coexists either with the incorrect method of upper chest breathing, or the correct style of abdominal or diaphragmatic

breathing. On the other hand, this costal respiration may be practised in a perfectly independent manner, without encroaching on the upper chest above or the abdomen below, only by people who have made a practical study of the subject.

I will now show you the middle chest or rib form of breathing, and you will notice that it occurs quite independently of the collar-bones above and the abdomen below. But this act, as an independent one, is a physical impossibility to those who have not trained their respiratory muscles.

The third and last method of breathing is the abdominal or diaphragmatic. This is the correct form of breathing, and is assisted by the ribs.

I have already explained to you that the diaphragm forms a dome-shaped partition between the chest above and the abdomen below, and resembles in a quiescent state an expanded parachute.

The convexity is towards the chest and the concavity to the abdomen. Directly we take a deep breath the diaphragm descends and flattens out at the sides, so pressing down the abdominal organs below; and, as a consequence of this, the exterior surface of the abdomen naturally assumes a rotund convex appearance. Then, when expiration occurs, the pressure on the abdomen is released and its surface loses its roundness of outline as the result of the diaphragm flying back to its original position.

I wish to lay great stress on the shape of the abdomen during respiration, as it is a common occurrence to see people take an inspiration, hunch their shoulders up, draw in their abdomen, and then expire and puff their belly out, and they are under the impression that they are breathing correctly, whereas it is the exact opposite that should take place. In correct breathing there should be no movement of the collar-bones or shoulders, but merely a forward and upward movement of the breast-bone, more especially the lower part, combined with the rib movement already described and the alternate enlargement and diminution of the abdominal walls.

The reason why this diaphragmatic form of breathing should be cultivated is not difficult to understand when I draw your attention to the accompanying diagram, with especial reference to the confines of the lungs.

I have already referred to the cramped condition of the parts above, and this is the extreme opposite of that below. Here, below, we have the broad bases of the lungs resting on and encompassed by soft and resilient structures. Here, the lungs have full play, and their movements are not hampered as they are above by close apposition to great blood-vessels and surrounded by an immobile casement of bone.

Mr. Lennox Browne, who wrote "Voice, Song, and Speech," in collaboration with the late Mr. Behnke, justly insists that the criterion of correct inspiration is an increase of size of the abdomen and of the lower part of the chest. Whoever draws in the abdomen and raises the upper part of the chest breathes wrongly.

The lungs at their bases are surrounded by soft and yielding

parts, which can be worked with the utmost ease, because Nature has not placed any obstacle in their way; but, unfortunately, many people are continually doing this themselves. This work was written for the purpose of teaching the best method of inflating the lungs with reference to song and oratory, but the facts are equally applicable to my present subject. I may here take the opportunity of tendering my thanks to the author for many valuable hints on the subject.

I now intend to give you a practical demonstration of the means I employ for developing the chest and otherwise strengthening the body. I have brought with me, from Aldershot, three recruits of the Medical Staff Corps, who recently joined the depôt, and who have been permitted by their commanding officer to take advantage, under my tuition, of a short course of breathing drill. (In all these exercises the individual must be stripped of his upper clothing.)

Exercise No. I.—Recumbent position, head slightly raised, arms close to the side.

Gentle breathing is now practised, which is entirely confined to the ribs and diaphragm.

The extreme upper portion of the chest, together with the shoulders, remain quiescent. There must be no movement of the collar-bones. For the purpose of resistance, a lightly diffused pressure, evenly distributed, is maintained over the seat of diaphragmatic action. This covering is made of a porous plastic material, which, after being moulded to the parts concerned, is fitted with weights, the total not exceeding $3\frac{1}{2}$ lbs.

Exercises Nos. II and III consist of the same exercise, sitting and standing respectively, only without the addition of weights.

Exercise No. IV.—The same position is assumed as in No. I. A full, deep inspiration is taken, the diaphragm is then fixed—this is done by holding the breath—and suddenly released by a forcible expiration.

Exercises Nos. V and VI.—The same exercise, sitting and standing respectively, without the addition of weights.

Exercise No. VII.—Recumbent position. Take a full inspiration—when the diaphragm is well down and the abdomen protruded, fix the former—then say the first four or eight letters of the alphabet and suddenly expel the air.

Exercises Nos. VIII and IX are the same exercise, sitting and standing, without the addition of weights.

Exercise No. X.—Recumbent position. Take a full inspiration, and whilst doing so raise two light dumb-bells from each side over the head to a half-right angle with the shoulders; now complete the inspiration, then forcibly expire, and replace the dumb-bells in their original position.

Exercise No. XI.—The same as the previous exercise, only practised on a form. The head should be well raised.

Exercise No. XII.—Recumbent position. Take a quiet and prolonged inspiration through the nose, followed by a similar expiration through the mouth. During the latter place a finger close up to and

almost between the lips and endeavour to control the exit of air without warming the finger.

Exercise No. XIII.—Take a quiet, prolonged inspiration and then forcibly expire.

Exercise No. XIV.—Take a hurried inspiration and then slowly expire with the finger to the mouth as in No. XII.

Exercise No. XV.—In the standing position, arms by side, with dumb-bell in each hand. Raise the dumb-bells at arm's length over the head during inspiration and lower to side during expiration.

Exercise No. XVI.—In the recumbent, sitting, and standing positions. A series of light respirations at the rate of about 360 to the minute.

Exercise No. XVII.—Take the hurried respirations as in the previous exercise for about five seconds, then a deep breath, and gradually expire.

I have now illustrated how a variety of exercises which, when practised regularly and in a careful manner, serve to educate the diaphragm in the various performances of its muscular duties. In order to develop any muscle it is necessary that there must be a certain amount of resistance. No muscle can be otherwise properly developed. For this reason I employ light weights with most exercises, but more especially those which are performed in the recumbent position. I find with my pupils that a slight pressure evenly distributed over the diaphragmatic area facilitates not only the method of explanation but also the practical results. Here is a shield which I recently designed for this purpose.

The diaphragm is quite as easy to train, with proper care, as any other muscle in the body; but, strange to say, owing probably to its being out of sight, it is entirely neglected. No trainer in athletics appears to devote a thought to the subject. A man who goes in for fencing, boxing, or running, devotes his training to the muscles concerned in these respective exercises, irrespective of the diaphragm, and little dreams of the enormous benefit that may be derived from training his bellows and learning to control his wind. There are many advantages to be gained by training this most important muscle in the manner I have just demonstrated. These exercises are the means of thoroughly well airing the lungs, and therefore cause a corresponding increase of respiratory capacity. This is easily proved by means of a spirometer, when it may be seen that a man who breathes correctly will have no difficulty in outrivalling a man who hunches up his shoulders every time he inspires.

They have a most beneficial effect on the general health and digestive powers, which is in great measure due to the increased oxygenation of the blood.

In weakly subjects with poor breathing capacity and delicate lungs they may, with judicious practice, be the means of establishing a robust condition of health.

So far as stammering is concerned, and when not due to any exciting cause, which may be removed by treatment, these exercises may be the means of effecting a speedy and permanent cure.

As an instance of this, here is a case in point. A few months ago at the Cambridge Hospital, Aldershot, a recruit was brought to my notice who stammered so badly that it was deemed advisable by the medical authorities to discharge him from the service. I applied for permission to treat him, but was at first refused on account of the apparent hopelessness of the case. Ultimately, however, I gained the required permission, and having satisfied myself that there was no need for surgical or medical interference, gave him a course of the above exercises, combined with reading drill, under my personal supervision, for one hour every day. He very soon showed signs of improvement, and in a short time was able to read a paragraph from a newspaper without any difficulty. At the end of three months he was practically cured, and had no difficulty either as "challenging" when a sentry, or "numbering off" on parade.

Another advantage to be gained is the increased expansibility of the chest. The greater the descent of the diaphragm the greater is the expansion of the lungs and chest walls. The lung power is therefore increased, as also is the amount of oxygen taken into the blood. The greater control a man has over his diaphragm the greater control he has over his breathing, especially when extra demands are made upon the lungs, in the way of getting rid of noxious products of combustion. His powers of endurance must therefore be increased. On the other hand, in that form of breathing where, during respiration, the collar-bones are raised and the abdomen drawn in, there is imperfect aeration of the blood, and this may lead, as I have before pointed out, to venous congestion of the upper extremity.

This style of breathing may be seen at any time with bandmen who play wind instruments. I have frequently noticed it at Aldershot, when on a Sunday I have watched the different regiments being played to church. Their faces are scarlet, the veins on the neck and temple are outstanding, and every time an inspiration is taken the shoulders are raised to a corresponding extent with the amount of fatigue. This condition might be easily obviated by a little attention to their uniform, so as to allow the breathing parts full play, especially at the neck and waist. A tight collar constricts the wind-pipe and a tight belt and tunic have a restraining effect on the bellows.

In addition to this every wind instrument player should be instructed in the method of being able to produce a maximum amount of sound with a minimum expenditure of power.

This, I have no hesitation in saying, can only be done by the means already described.

The same remarks would apply also to buglers.

The three recruits which I have brought with me to-day have been practising these exercises since the 10th of last January. On that date their chest measurements, which were taken by an officer of the A.M.S. at Aldershot, were as follows:—

	Min.	Max.	Expansions.
Cowland	32 $\frac{1}{2}$	34 $\frac{1}{2}$	+ 2 ins.
Swetland.....	33	34 $\frac{1}{2}$	+ 1 $\frac{1}{2}$ "
Holmes	33 $\frac{1}{4}$	36 $\frac{1}{4}$	+ 2 $\frac{1}{2}$ "

On the 1st March they were again measured by the same officer, with the following results :—

	Min.	Max.	Expansions.
Cowland	32	35 $\frac{1}{4}$	+ 3 $\frac{1}{4}$ ins.
Swetland.....	32	35 $\frac{3}{4}$	+ 3 $\frac{3}{4}$ "
Holmes	32 $\frac{1}{2}$	36 $\frac{1}{4}$	+ 3 $\frac{3}{4}$ "

In every instance there is a gain of chest expansion, which, considering the short period these exercises have been practised, tends to show the importance of this form of training.

The reason men are rejected for the army, so far as chest measurement is concerned, is because they neither know how to fill their lungs with air on the one hand, nor empty them on the other.

Give me any recruit who is healthy, but still does not come up to the required standard of chest measurement, and I will guarantee that in a few weeks, by means of the diaphragmatic drill I have shown you, that I will expand his chest to the necessary requirements.

My experience is the younger the man the more satisfactory the results.

So far as my own experiences are concerned, I commenced practising these exercises about 10 years ago, at which time I was completing a course of singing lessons. I experienced great difficulty in controlling my breath, especially whilst executing long passages, and frequently asked my master to give me instruction in the art of breath control, but he always replied, "As long as you breathe in the right place, and phrase correctly, you may take your breath how you like."

At that time my chest expansion was 2 $\frac{1}{2}$ in., but on my subsequently employing the form of breathing I am now advocating, my chest gained corresponding strides in development, and at present, I have 6 in. expansion between my minimum and maximum. This measurement was accorded me, a short time ago, by two officers at Aldershot, on the occasion of my giving a brief demonstration on this subject at the military gymnasium.

To singers the subject of this paper is most important, but time will not permit me to dilate on my experiences, so far as this portion of the question is concerned. So I must reserve my remarks until I have an opportunity elsewhere of specially addressing musical people on the subject of breathing as applied to singing.

With reference to the recruit, I would recommend a course of these exercises at the time he undergoes his gymnastic training, and I consider it essential to his advantage that they should be exercised under the supervision of a medical officer.

General the Honourable W. H. FEILDING: Mr. Chairman, being Inspector-General of Recruiting, this is to me one of the most interesting subjects that could possibly be touched upon, one that I have long wished to see raised and properly discussed. Anything that can make the recruit a man before you begin to make him a soldier, cannot fail to facilitate the real operations of recruiting, viz., the supply of recruits who can easily and quickly be fitted for the duties of soldiers. It

has, too long, been the notion to begin at the wrong end—to try to make a recruit, before he is fit to bear fatigue, into a soldier. This tends to wear him out prematurely. The lecturer's remarks have been extremely interesting to me, because he has explained and given theory and practice for the "rule of thumb" way by which we have been trying to inculcate the same practice ever since I have held my present appointment. At my inspections I invariably tell the officers in charge of the recruits who come from the factory districts, that before each recruit's drill begins, the squad should go through what we call "breathing drill," and the breathing drill is, practically speaking, a modified form of what our lecturer has so very lucidly put before you; but since, unfortunately, the time at our disposal for the training of the recruit is very limited, I should like very much if the lecturer could put in a short form some course not so long and which, though not so complete in its effects, would facilitate the recruit's training and after-life, through the development of his breathing power. I hope he will be able, before we separate, to give some sort of idea by which we can get at a more accurate appreciation of the measurement of chest expansion. The regulations, as far as we can make them do so, prescribe that the medical officers should judge much more of a recruit's fitness for a soldier's life by his chest expansion than by the actual minimum measurement of his chest, and I had a curious instance of that in the case of a recruit whom I authorized to be specially enlisted in 1891, although measurements on his enlistment were only $29\frac{1}{2}$ minimum and $31\frac{1}{2}$ maximum. He was the smallest chested man I ever allowed to be enlisted. That was in 1891. I went down by chance to Aldershot to the gymnasium to see a squad of the Northamptonshire Regiment go through their gymnastic course, and opposite me was one of these men, and I noticed how extraordinarily small he was at the chest, and yet how very easily he did all his gymnastic exercises, which lasted very nearly three-quarters of an hour, with only one very short stoppage for rest. At the end of the drill I asked that the men should strip to the waist, and I pointed out one or two men to be measured. The man who was actually opposite to me showed 6 in. expansion, and I found out that this was the man in question who had enlisted, and who, as a clerk, had spent all his life time in scribbling, with bent shoulders, over a desk; but the result of gymnastics at one of the depôts where breathing drill had been enjoined, was that this fellow had this marvellous expansion. It is recorded in my Annual Report for that year, and I was so struck with it, that I sent it to the Director of the Army Medical Department. I think that this shows clearly that we ought to be guided more by the chest expansion than by actual maximum or minimum chest measurements; all the more so because we really never can get a true minimum measurement from a recruit, especially so in the recruits that are enlisted in the manufacturing towns where they stand over looms and hardly ever breathe pure air, and therefore breathe as little as possible in the proper way. They are unable to do it; and therefore the first thing to do with them is undoubtedly to practise them in a form of breathing drill. If the lecturer could put forward some scheme to the Army Medical Department by which we could have a short but efficient course of breathing drill applied to every recruit when he first comes, I am sure the army would be very much indebted to him.

Surgeon-Major-General JAMESON: There was one remark of the lecturer in reference to the difference between the minimum and maximum of the chest girth of recruits. He spoke of it in one instance as being about 1 in. Under the "Regulations," no recruit would be accepted with only 1 in. of expansion. The expansion of the lungs estimated by the difference between the maximum and minimum is a great criterion of a man's condition; and to accept him with only 1 in. difference is wrong in every way. It is not in accordance with our experience that men have such small expansion. For example, at the St. George's Barracks, where most of the recruiting takes place in London, the average difference between the minimum and maximum is $2\frac{1}{2}$ in. Without any elaborate system of using your diaphragm, instances occur in which the difference of the two measurements is in some countries as much as 7 in. between the minimum and the maximum. I may mention, in taking the measurement, it is not the actual minimum that is taken; it is the minimum of actual breathing after an ordinary

expiration, not after a forced expiration. I have made experiments to show the difference between the two. By using a forced expiration you can get a difference of about $\frac{1}{2}$ to $\frac{3}{4}$ of an in. less than after an ordinary expiration; and in reference to the ordinary development that takes place in the chest of the recruit, we all know that in a regiment the ordinary condition of development within six months after a man joins is somewhere about 2 or 3 in. of chest measurement, and that occurs through ordinary training. I belonged to a regiment in which we took very great pains over a series of years to measure the men after an ordinary three months' course of drill in the gymnasium, and I found the average increase was about 3 in. In some cases we got $4\frac{1}{2}$ in. with men whose appearance did not denote great capacity for improvement. All these experiments that I have seen here to-day have been conducted on men in a state of rest. I should like to see them conducted on a man after hard exercise, and see where the diaphragmatic breathing comes in then. If a man is in great need of air, as after very hard exercise, he uses every muscle he has; he expands his lungs in all directions. You see the upper part work, the lower part work, every part work. He is struggling for air. That is what one sees after very hard exercise, such as a sprinter who runs 250 yds. as hard as he can go. What is the result? That man has, in the course of his exercise, manufactured within himself a large amount of carbonic acid gas, and he is trying with all his power to get rid of it. How does he get rid of it? The difficulty is in expiration, not in inspiration. The difference in length between the expiration and inspiration is as 1 to 3. He has no difficulty in inspiring; the whole difficulty is in getting rid of the carbonic acid, which has produced auto-intoxication of the blood. This carbonic acid is produced only by the violent use of a large group of muscles in a limited time, such as the muscles of the leg. If you use the muscles of the arm, you produce weakness of the muscles of the arm, but you produce no breathlessness. To produce breathlessness you must use a large number of muscles violently and in a short time. The result involved is a large development of carbonic acid, which poisons the blood, and to get rid of it the man makes every effort in his power by expanding his lungs in all directions. It struck me in seeing that man breathe he was breathing by the lower part of his lungs; the upper part of his lungs were hardly breathing. What is the result of that? The apex of the lungs is not being used. The apex of the lung is the part of the lung most liable to disease. I rather think by that kind of breathing a considerable danger is produced, namely, the danger of consumption. The upper part, the weakest part, of the lung is not properly filled, for the lower parts are being filled at the expense of the rest of the lung. In regard to the cure for stammering, that was probably cured by the ordinary reading exercise. That is the exercise used at all times for curing stammering. Holding the breath for a minute and a quarter is by no means extraordinary. The pearl divers have the power of staying in the water for two minutes. The way they do it is by preparing the lungs before descending. A pearl diver on going into the water takes three forcible inspirations and three forcible expirations, and at the end of the expirations he goes down. What he has done in the meantime is to aerate the blood sufficiently to last him a considerable time and to get rid of the buoyancy that accrues from inflation of the lungs.

MR. A. BARNARD: Of course it would be an impertinence on my part to in any way attack this question from any other than a layman's point of view: that is to say, from the practical point of view. I have been connected with gymnastics for 20 years. I am at present captain of the Orion Gymnastic Club, and it has been in connection with that post that I have gained the experience of which I will give you one or two examples. I must, to begin with, join issue with the lecturer on one point, although, perhaps, not altogether. He says in part of his lecture that "no trainer in athletics appears to devote any thought to the subject." I may be permitted to remark that at the Orion for 12 years we have given distinct and specific attention to that one question of deep breathing. I am not prepared to say we have taught it with exactness and correctness shown here this afternoon, though I hope now to be able to do it; but, at the same time, we have done our level best to teach people that the great thing has been to fill the lungs, and not simply pant, like nine people out of ten do. Our attention was first drawn to this

by a book which I think might be read by every one with advantage; it is called "How to keep Strong," written by an American gentleman named Blakie. The Americans are considerably ahead of us in their literature on matters connected with physical development. I do not like to say that, as an Englishman, but I content myself with the statement of fact. In that book, Mr. Blakie insists upon the necessity of deep breathing. He puts it forth as an axiom that the development of a man must start from the inside, not from the outside. I know I am speaking in the presence of many medical men, and I will explain perhaps more clearly what I mean. You frequently notice with a man who, when stripped to the waist, has an enormous chest development of muscle, that if you took that muscle off you would find a very small breathing capacity underneath. Now that has been brought before my notice very often. I have more than one prominent case before me in which a man with that development has suddenly collapsed, for no apparent reason; but by the light of what I have read since, and of what the lecturer has now told me, I have not the least doubt it was simply through the improper aeration of the man's blood. Another example arising from the same cause is well known to you all. I have often had men under me, in various forms of competitive athletics, who have not lacked pluck, but they have always lacked stamina, and I believe that has been through the improper use of their lungs. What we have to start with is the axiom that Mr. Blakie lays down, namely, that the development of a man must start from his inside; that is to say, he must first be taught how to use his lungs, and after that attend to muscular development. The course I adopt is this: when a man joins he is tested as to physical capacity, put in a squad, graded according to his capacity. When we examine these men on joining we invariably draw attention to the French method of breathing, and in many instances men have come to me months or years afterwards and said what great benefit they have derived from it. They have not understood the physiology of the question; they have done it for mere mechanical practice, and they have had not only additional skill as athletes, but they have found it materially assist in their general health. I may draw attention to what I consider the very dangerous habit of wearing a webbing belt. We see the custom adopted at military gymnasia and in many amateur gymnasia. I believe it to be most dangerous, and certainly one that prevents the direct use of the lungs. That is one thing I should hope later on to see abolished. The last speaker referred to one point: he said the breathing is not hurried through hard work by the arms and legs. If I heard him correctly, I must very strongly differ from him. Putting a man to climb a rope by the use of his legs and arms, if that man is not very soon winded he is an unusually strong man. I make that remark with all deference, because I, who am only a layman, may have misunderstood the point which the gentleman has brought forward. He asked us also to notice how the man breathes after hard work. Unquestionably most men simply pant after hard work; they do not breathe. We try to get men, when they have done hard work, to steady themselves down from the nervous point of view, and then take one or two careful deep inspirations. The result is simply marvellous: the man recovers breath immediately; he quiets down, his nerves get right, and the man is all right. We cannot get all men to do that, but, where he can, that man has a distinct pull over the man that cannot. In conclusion, I would give my own personal experience on the question of deep breathing. My attention was first drawn to it 12 or 15 years ago through reading Blakie's book. I was at that time in about the best muscular condition I am in at any time during the year. My net weight was about 8 st. 5½ lbs. At that time I could breathe, when I first tested my maximum breath, up to 35 in. I could not get any more air into my lungs. That was the extreme favourable I could come to. I practised deep breathing for five minutes at a time, and, as a result, gained an expansive power of an additional 3 in., and was able to breathe up to 38. I think that fact alone is one that puts all objections to the necessity of practising deep breathing utterly out of court.

Captain O'CALLAGHAN: I would ask you, sir, and the other members of the medical profession who are present, to receive with every allowance any remarks that I, as a complete outsider, may have to offer. I would simply say that whenever I take a very deep inspiration, which I am in the constant habit of doing, I feel the whole three systems of breathing—the whole three classes of breathing—

to which the lecturer has referred: not only the abdominal but the costal breathing and the breathing of the upper part of the lung; and I cannot help thinking that it is an advantage to fill all the lung as far as possible, and to get rid as much as you can of the residual air by a complete expiration. I regret the absence of one who has given a good deal of time to this question, whom I met accidentally—a Dr. Hambleton, who has written a good deal on this subject, and whose experience appears to me to be very valuable. He told me that if his system of exercises, which he has practised, I believe, with some success, were to be introduced generally, 36 in. might be fixed as the minimum chest measurement of the smallest recruit. I am sure the mere mention of his name, and what he has done and said, may evoke some remarks from those who are more conversant with the subject than I am.

Surgeon-Captain DEANE (Medical Staff): I think there is one application of Surgeon-Captain Dixon's paper which is worthy of attention, and that is with reference to the first position of the soldier—the position of attention; and I hope, and my hopes are greater now than they were when I came in, owing to the remarks of the Inspector-General of Recruiting, that Surgeon-Captain Dixon's paper will be the real starting point of a new era in the physical development of the army. My hopes are greater, and I will tell you why. Some years ago a very experienced soldier and officer in the Indian Army told me that he had had the curiosity at one time to look up the history of reforms in the Service, and he found that they occupied 70 years from the time they began to be talked about until the final accomplishment. But I think with Surgeon-Captain Dixon's paper published in the press, and with the support of the Inspector-General of Recruiting, we may divide that 70 by 12, perhaps. The position of "Attention" of course refers to the complete position of the soldier, which I do not want to go into except as to his breathing. The position of "Attention" as regards the feet, and so on, is mechanically and physiologically wrong, but that I do not concern myself with now; it is simply the breathing. The man is told to stand up, to draw his shoulders back, to force the chest out, and to draw the belly in. I may mention (I cannot explain it deeply, but my professional brethren will understand what I mean) what is the cause of respiration—the sucking action of the chest—*aspiration*. Aspiration has an effect not only on air but on fluids. If you get an air-exhausted ball and put it into water it will suck in water, or in air it will draw in air. That suction action of the chest is acting not only on the air in our lungs but on the heart and on the enormous blood-vessels filled with blood which Surgeon-Captain Dixon has told you pass from the head and neck into the chest through the narrow fixed upper opening. What does that mean? The man draws in his belly; he stops all respiration; he forces out his chest. I have seen it over and over again. The respiration is practically stopped. He keeps the chest at a medium state of inflation. The suction action is going on drawing the blood from the head and neck and the large blood-vessels into the heart, with the result that the recruit with three months' service so often presents himself at our station hospitals for palpitation and what we call "irritability" of the heart. I think Surgeon-Captain Dixon will earn the thanks of the whole medical service of the British Army if his paper will do anything to modify that position of the chest in the position of "Attention." And I recognise that there is a great deal of obstacle in the way; for this reason: the military mind is thoroughly imbued—and I am speaking from personal practical experience—with the idea that a man's chest is here (pointing), and drill instructors, sergeant-majors, and gymnastic instructors are always telling their men, "Force your chest out." It is like putting a poker down a man's mouth to prize the breast-bone out. He cannot force the chest out, he cannot afford to do it, he is restraining his respiratory power. There is one point pregnant with wisdom in Surgeon-Captain Dixon's paper, and that is where he says the diaphragm is neglected because it is out of sight. The soldier, they say, must have an imposing appearance, and he gets that imposing appearance by forcing out the upper part of the chest where Nature never intended the most important part of the chest to be. With reference to Surgeon-Major-General Jameson's remarks about diaphragmatic breathing being carried on during exercise, I may speak on that from a little practical experience. I have always recognised the importance of

beginning to draw a deep breath from the diaphragm. The military way of drawing a deep breath is from above downwards, with the result that it is done imperfectly. The physiological way, as Surgeon-Captain Dixon has so well told us, is to begin and follow the indication that Nature gives us, that is, to begin with the diaphragm and spread upwards. Then you get not only the bases of the lung inflated, but also those much-abused apices which you do not expand properly by breathing into the upper part only and leaving the bases alone. I have gone in a great deal for what, perhaps, you may call weight lifting—the use of heavy dumb-bells, and I can assure you you can get pumped by using an 80 lb. or 90 lb. dumb-bell five or six times quite as much as by using a lighter one. Lately I have noticed, since I have practised this form of breathing more, that, after my working, if I have got a little distressed from the exertion, I have recovered my breath sooner and been able to continue the exercise sooner by fixing my attention on my diaphragm. I lie down either on the floor or on the sofa, and breathe diaphragmatically, and what before took me two dozen breaths to accomplish in the way of recovery I can now do in six. With reference to the remark about holding the breath, I think perhaps Surgeon-Captain Dixon's experiment may not have been understood by everybody. He was not holding his breath; he was doing what is the most difficult of all respiratory acts—controlling his expiration. He was expiring a continuous stream of smoke from his mouth, which I know he can do for a minute and a quarter. There is one remark I should like to refer to, made by the Superintendent of the Orion Gymnasium, that is, with reference to belts. No doubt in some parts of the army they wear belts where, as he says, they should not be worn, constricting the abdominal muscles, and so preventing breathing. But where the belt should be worn, and where it is worn now, at all events at Aldershot, is so that it grips the hip bone. That was made a great point of by the late Dr. Roth, who perhaps knew as much of the subject as most people. He was great on chest expansion and respiration, and he went so far as to abolish braces among his patients, which are a source of great deformity by the way. He abolished braces, and put a band in the trousers of his patients which gripped the hip bone without constricting the abdominal muscles in any way and served the natural purposes for which braces were intended. I can certify to Surgeon-Captain Dixon's chest expansion, and I must say the members present have lost a great deal by not seeing him perform experimentally more in person. He has got the most wonderful control over his ribs and diaphragm of any man I have ever seen. He can breathe with one side of the chest and keep the other fixed, and I can certify that he has a chest expansion of a little over 6 in., for I was one of the officers who measured him.

The CHAIRMAN (Mr. Lennox Browne): I will venture to say a very few words on points that have struck me in reading and also listening to this admirable paper. I am sure all those present who belong to the medical profession will agree that the anatomy and physiology have been very clearly and, at the same time—which is not always in combination—correctly described; and on his part Surgeon-Captain Dixon may well feel proud of the reception that has been accorded to his paper by so competent and high an authority as General Feilding. This question of commencing the respiratory act at the diaphragm is most important, and I regret that I am obliged to speak with some disagreement with the opinion of a colleague in my profession, Surgeon-Major-General Jameson. The fact is this, we divide the act of breathing into three methods, diaphragmatic, often called abdominal rib, costal or lateral, and clavicular or collar bone; but it is impossible, except to a gymnast, to do the lateral or rib breathing without commencing with the diaphragm; but if you commence with the diaphragm you must of necessity expand the ribs, the latter overlapping the former. On the other hand, it is almost certain that if you commence breathing by expansion of the ribs without using the diaphragm you will extend it to the elevation of the collar bone, that is, to clavicular breathing. Surgeon-Major-General Jameson has objected to the fact that these exercises were done in repose; but he should remember that we were not shown the action of the man in breathing by Captain Dixon's method in the position of either standing or sitting. Of course, solely to save our time, breathing in the standing posture would represent the amount of chest expansion when in motion;

and Major-General Jameson may be assured that however trying the exercise of breath taking is begun by contraction of the diaphragm, there is no occasion whatever—presupposing a state of health—to draw up the collar bone, and that act is an hindrance and in no sense an advantage. There are certain points not alluded to by Surgeon-Captain Dixon, probably from want of time, with reference to the diaphragm, one is that from its anatomical connection with the pericardium—the covering of the heart—and its continuity with the deep tendinous covering of the muscles of the neck, which we call the deep cervical fascia, the act of breathing by elevation of the collar bone draws on the heart, and leads to a serious strain on that organ and to a general congestion of all the large blood vessels. I disagree with Captain Dixon slightly in that he considers that the diaphragm is put in any degree to useful action in collar bone breathing, for in point of fact its normal action is opposed; and, as to clothing and uniform, it is not so much the tightening of the neck by the stock to which attention was drawn so long ago by Baron Larry and, in later years, by Mr. Myers, who was surgeon in the Coldstream Guards, that leads to heart disease, for that matter has been remedied, as it is very imperfect and exaggerated respirations. The ill effects of collar bone breathing may well be responsible—without considering the question of collar—in bringing about an over-dilated heart, and a tendency to aneurism; for this actual stretching of the cervical fascia attached to the pericardium by the elevation of the collar bone is, in itself, a source of heart weakness, and of over engorgement of the large vessels, even to the extent of aneurism. Another point has to be considered with regard to this diaphragmatic breathing, that is, with every act of inspiration, the blood pressure, as proved by an instrument called the sphygmograph or pulse graphic recorder, is increased; in other words the heart has more work to do; this takes place in normal breathing. How much more likely is it to occur in an increased degree in exercise, as in running or climbing? If the diaphragm is brought into play, not only is the chest capacity for the time being increased, but the breath-holding power, such as Surgeon-Captain Dixon has shown in that misunderstood experiment of controlling the exit of the breath, is also increased, and, therefore, so far from its not being useful in exercise, it diminishes fatigue and lessens the tendency to disease. Another useful reason for performing these exercises in the recumbent position is, that in that posture, except in illness—where there is a fight for life due to some disease of the respiratory organs—movement of the collar bone is impossible. You will see at Madame Tussaud's, and at other exhibitions, a representation of a breathing figure. The manufacturers thereof have recognised the correct mechanism of breathing in sleep, and you will always see that these sleeping figures are made to breathe with the diaphragm and the lower resilient chest walls, and with a complete immobility of the collar bone and the upper or fixed ribs. Many of these exercises, as Surgeon-Captain Dixon knows, are based on what has been taught by us for the last 20 years with regard to singing; but Exercises 10 and 15 are most original and excellent. The Exercise 16 of rapid panting of the diaphragm is, I suppose, intended to give suppleness to that muscle, and so make it more capable of controlling the exit of air. One word about these weights over the lower chest when exercising in the recumbent posture. The history of them is very curious. Sir Morell Mackenzie, in an article in "The Contemporary Review," in August, 1889, pointed out that Nero, who, although a detestable man, no doubt, politically and socially, was a most enthusiastic patron of the arts, and was particularly vain of his voice, used to lie on his back with a small plate of lead on his stomach. This, Sir Morell Mackenzie argued, was used for checking the tendency to so-called abdominal breathing, but as I contended in a rejoinder in the same Review (September, 1889), the small leaden plate on the stomach was in the nature of a dumb bell, as explained to-day by the lecturer. Now, curiously enough, Surgeon-Captain Dixon did not know of these articles in the "Contemporary," nor did I know at the time that my late collaborator, Mr. Behnke, in his breathing exercises, would first teach the pupil, by placing the flat of his hand on the stomach, to feel that he was lifting the lower chest walls; and in all cases of stammering he taught them to place a weight, such as above, in the same situation, for the purpose, not of checking, but of strengthening muscular action by offering some degree of resistance. One of the handicaps of a chairman on such an occasion as

the present, is that the wind is very often taken out of his sails, so that when the time arrives for him to speak, there is not much left for him to say. I allude particularly to the admirable remarks of Surgeon-Captain Deane, and I entirely agree with what he has said as to the general misconception of where the chest, so far as respiration is concerned, is situated. Our opponents say "you teach abdominal or belly breathing;" nothing of the kind, we teach deep chest breathing; and here, once more answering Surgeon-Major-General Jameson, if you practise deep breathing, the apices or tops of the lungs will be better filled than they are when the collar bones are drawn up as is commonly and erroneously contended. I venture as a civilian to say that I have never seen a regiment on parade but I have felt that the position of the soldier is most unphysiological, and I am glad to have heard Surgeon-Captain Deane's remarks on that subject. I had intended to have referred to that point, but I could not have hoped to illustrate it so forcibly as he has done. I am pleased also to say I have learned considerably from the other gentlemen who have spoken, especially from Mr. Barnard, and I feel myself all the stronger to combat the fast-dying opposition to the views advocated by our lecturer. I will now call on Surgeon-Captain Dixon to answer the remarks of any speaker who may have appeared to differ from him.

Surgeon-Captain DIXON (in reply) said: To General Feilding I would say that, so far as the chest expansion goes, it alters a good deal. You may take a man's measurement one day, and find it entirely different the next. I need hardly say, in response to your invitation, that I should be only too pleased to furnish a brief and useful sketch to the military authorities of the drill I have shown you to-day. To Surgeon-Major-General Jameson I would say that it is not impossible to recruit a man because he has only 1 in. chest expansion. If his age is reasonable, and he is desirable in other respects, he may be enlisted as a "special." Concerning a man with huge chest expansion, like Sandow for instance, it is merely a question of muscular development. He shoots his pectoral muscles out in front, and scapular muscles behind, and the result shows an extraordinarily large chest measurement. But take a knife and pare these muscles off, and then measure his chest expansion, and the result would probably show it to be very small. With reference to my exhaling a continuous volume of smoke for over a minute, it has nothing to do with the pearl diver. The diver may go under water for two minutes, I know, but put a looking-glass in his hand, and tell him to breathe on it in one continuous exhalation for two minutes, and I think you will find that after about 15 seconds he will be very glad to give it up. I congratulate Mr. Barnard on the good work he has done at the Orion Gymnastic Society, and shall always be pleased to give him any assistance I can. In conclusion, I beg to thank you all, Mr. Chairman and gentlemen, for the kind, indulgent manner in which you have received this paper.

NAVAL AND MILITARY NOTES.

NAVAL.

Home.—The 1st of this month was the 100th anniversary of the last of the series of naval actions which culminated in the great victory on what is known as the "Glorious First of June," when the English fleet, under Admiral the Right Hon. Earl Howe defeated the French fleet under the command of Rear-Admiral Villaret-Joyeuse. The two fleets may be said to have been equal, each consisting of 26 ships-of-the-line; as the result of the battle, seven of the French ships were captured and all brought safely to England with the exception of the "Vengeur," 74 guns, which was so much damaged that she sank with 200 of her men before they could all be rescued. The English loss was 1,148 officers and men killed and wounded, that of the French 3,000 killed or mortally wounded, and 4,000 more slightly wounded or made prisoners. The rich convoy, which was on its way from America to France, and to capture which was one of the objects of the English Admiral, succeeded in reaching a French port safely. More fortunate than Villeneuve at Trafalgar, Admiral Villaret-Joyeuse not only brought his own flagship safely out of the action, but was promoted to Vice-Admiral; so it would seem that the safe arrival of the valuable convoy was considered more than a set-off for his defeat.

The following are the principal appointments which have been made:—Admiral Sir N. Salmon, V.C., K.C.B., Commander-in-Chief at Portsmouth, in succession to Admiral the Right Hon. the Earl of Clanwilliam, K.C.B., who has completed his three years' term of command. Captains A. Moore to "Britannia;" A. Fanshawe as Assistant to Admiral Superintendent of Naval Reserves; J. H. Bainbridge to "Alexandra;" H. T. Grenfell to "Benbow;" A. G. McKechnie to "Blenheim;" J. W. Brackenbury, C.B., to "Terror" for Bermuda Dockyard; C. J. Barlow to "Endymion;" J. H. Rainier to "Rodney;" Commanders P. C. Underwood to "Raccoon;" H. M. Tudor to "Barrosa."

The 1st class battle-ship "Rodney" has been commissioned for the Mediterranean to relieve the "Dreadnought;" the 2nd class battle-ship "Superb" has been paid off, and her officers and crew turned over to the 1st class battle-ship "Benbow," which takes her place as 1st reserve ship at Greenock; the 1st class belted cruisers, "Immortalité" and "Narcissus," attached to the Channel Squadron, have also been paid off, and their officers and men transferred to the new 1st class cruisers "Blenheim" and "Endymion" respectively; similarly, the 3rd class cruiser "Bellona" has been paid off, and officers and crew transferred to the 3rd class cruiser "Barrosa;" the 3rd class cruiser "Acorn" has been commissioned to relieve the "Racer" on the south-east coast of America, and has left for her station.

The new 1st class cruiser "Theseus" has been passed into the A Division of the Reserve at Chatham, and is now ready for commissioning, as also the 2nd class cruiser "Astræa" at Devonport. The Admiralty have introduced a new kind of mounting, at present intended for 4.7-in. Q.F. guns only, but with certain modifications it will be adapted for the 6-in. Q.F. gun. It is to be known as the 4.7-in. Mark III pedestal mounting, and will supersede the Marks I and II central-pivot mountings. The gun is worked from a pedestal, inside and at the bottom of which

is a brass cup containing 13 1-in. steel balls on which the gun and mounting revolve. Hitherto the guns have been dependent for their training on 18 rollers worked on a roller path; but, owing to their liability to be temporarily disabled by some foreign substance, this method of training was not altogether satisfactory. As the ball bearings of the new mountings are enclosed in the pedestal, it is impossible for them to be affected by any outside agency. One great advantage of the new pedestal mounting is that, as the heavy rollers and roller path can now be dispensed with, their equivalent in weight can be utilised by strengthening the shield which protects the gun's crew. The new shields will also be fitted with a sliding roof 3 in. thick. The roof and front of the shields will now be able to resist projectiles fired from 6-pr. Q.F. guns at a distance of 700 yds., and from 3-pr. Q.F. guns at a distance of 100 yds., whilst the fire from machine-guns is rendered practically useless even if the thinnest parts of the shield are struck. The new mounting will be supplied to the cruisers "*Charybdis*," "*Cambrian*," "*Forte*," "*Fox*," "*Flora*," and "*Hermione*," and to all vessels that are to carry 4.7-in. Q.F. guns, which have not yet been supplied with their armament. The work of making a suitable mounting of similar type for the 6-in. Q.F. guns has been taken in hand, and is expected to be completed in time for supplying the new cruisers "*Talbot*," "*Minerva*," and "*Eclipse*," now in course of construction.

The decision to fit sponsons to the new 2nd class cruisers has necessitated important alterations in the plans of the "*Talbot*," "*Eclipse*," and "*Minerva*," these vessels, as is known, are improvements on the "*Astræa*" class. Their armament will consist of all Q.F. guns viz., five 6-in., six 4.7-in., eight 12-pr. (new type of gun), and one 3-pr. Hotchkiss. The 6-in. guns will be mounted:—One on the centre of the forecastle as a central-pivot gun, and one on each side forward in sponsons; the others will be mounted also in sponsons, one on each side, right aft. The 4.7-in. guns will be mounted on the broadside, three on either side of the upper deck. The 12-prs. will be mounted:—Two right forward (one on each side of the forecastle), two right aft (in the captain's cabin), and four on the broadside between the 4.7-in. guns. By this method of mounting the vessel will be able to fire right ahead with five guns, viz., three 6-in. and two 12-prs. For right astern fire two 6-in. guns and two 12-prs. will be available, while the six 4.7-in. and four 12-prs. mounted on the broadside will be capable of firing 60° before and abaft the beam. Great as this improvement is, when compared with the obsolete method adopted in the new vessels of the "*Latona*" type, we must yet point out that even now the new ships will be inferior in end-on fire to the latest types of French 2nd class cruisers; the "*Chasseloup-Laubat*" and her sisters can bring to bear either ahead or astern three 6-in. Q.F. and two 4-in. Q.F. guns, while the "*Descartes*" type can fire right ahead or astern with two 6-in. Q.F. and four 4-in. Q.F. guns. We also hope that the new cruisers will be fitted with military masts and fighting tops; for, as we have before pointed out, if our present ships had to fight a close action with the new French cruisers, they would be seriously handicapped by the heavy fire from the small Q.F. guns, so many of which are mounted in the double fighting tops of the French vessels, and to which ours could offer no adequate reply. Sponsons are also to be fitted for the two foremost and two after 4.7-in. Q.F. guns of the nine vessels of the "*Astræa*" class.

During the gun trials of the "*Astræa*" type of cruiser it was discovered that the 6-in. Q.F. gun mounted on the forecastle was unable, without great risk of damage to the vessel's stem, to fire a projectile right ahead with sufficient depression to ensure the shot striking the water within a distance of 1,000 yds. As this would practically put the gun out of action if required to repel a boat attack from right ahead, it has been decided to raise the forecastle gun and mounting about 6 in. by means of an iron ring of that thickness; this has been done in the "*Astræa*," and the new fitting tested, with the result that it will now be possible to fire projectiles to strike the water right ahead close to the vessel's bow without endangering the stem or fittings.

The new 1st class cruiser "St. George" has completed her gun trials satisfactorily. Two rounds of cordite charges, weighing 13 lbs. each, were fired from the 6-in. guns on the upper and main decks at elevations of 1° and 10° respectively. The recoils varied from $11\frac{1}{2}$ in. to 13 in. The two heavy 22-ton 9.2-in. guns mounted forward and aft are carried upon ordinary pivot mountings, having their bases flush with the deck, and consequently exposed to the fire of an enemy. In the new mountings designed for guns of the same nature, the base of the shields will be protected by raised belts formed of 6-in. armour. Two rounds were fired from the forward gun, the first with a reduced charge with 1° of depression, and the second with a full charge with 10° of elevation, or 5° below the maximum. The recoils were 2 ft. $8\frac{1}{2}$ in. and 2 ft. 9 in. The same test was applied to the after gun—first round (reduced), horizontal, 2 ft. $8\frac{1}{2}$ in. recoil; second round (full), 10° elevation, 2 ft. $8\frac{1}{2}$ in. recoil. No miss-fire occurred, and the trials passed off without a hitch.

Captain Beaumont, of the "Excellent," has forwarded his report on the recent experiments with the 12-pr. Q.F. gun on the "Havock." In his conclusion he says that the value of the 12-pr. mounting above the conning tower is confirmed by the experiments, as the gun pierced the funnel of the dummy torpedo-boat in eight rounds at 1,200 yds., the "Havock" at the time proceeding at a good speed. It pierced the boiler, conning tower, and the compartment between at 800 yds. in eight rounds on the second run: it pierced the funnel twice in seven rounds on the third run, and pierced the turtle back and conning tower with eight rounds on the fourth run. Six carefully-aimed rounds were averaged per minute, and the supply of ammunition could keep pace with this rate, but could not be made faster. Captain Beaumont also reports on the mountings of the 6-pr. Q.F. guns on the "Havock" that several alterations are necessary to make their working effective.

The Admiralty have directed that the battle-ships "Royal Sovereign," "Empress of India," "Resolution," and "Repulse," and the 1st class cruiser "Blenheim" are to be supplied with cordite charges in the place of black powder charges for use with the 6-in. Q.F. guns. As the cordite charges for these guns are being supplied for experimental purposes, they are to be used exclusively for practice. The new charges are to be stowed in the hottest magazines of each ship in order that the test of the cordite may be as severe as possible. At the end of six months the captain of each ship is to furnish a special report on the cordite used and that remaining under his charge.

An interesting proof of armour-piercing projectiles, manufactured by Messrs. Thomas Firth & Sons, of Sheffield, was lately carried out at Shoeburyness. One hundred and sixty 9.2-in. shot, weighing 380 lbs. each, were presented by the firm for reception tests, and two projectiles were selected at random for the proof. The first was fired with a striking velocity of 1,958 ft. per second against a 14-in. compound plate. This was successful in an extraordinary degree, the shot passing through the centre of the plate, then through 4 ft. of oak backing, and burying itself in a heap of sand in the rear. When recovered the shot showed no cracks, and was practically undamaged, beyond a slight bulge near the front band, and the total shortening of the projectile on a length of 29 in. was only three-fifths of an inch. This round was considered so satisfactory that it was not considered necessary to try a second one. It may be mentioned, in view of statements made by experts, to which allusion was made in the House of Commons, to the effect that French shells are better than Sheffield ones, that this is almost the only projectile of large calibre that has given such satisfactory results under similar conditions.

Instructions have been given that in all 1st class battle-ships of the "Royal Sovereign" class, the wing spaces abreast of the coal bunkers proper are to be used as auxiliary bunkers, and the full stowage of coal is always to be taken on board when the ships are coaled. Hitherto this class of vessel has been able to stow 900

tons, but by utilising the wing spaces it is expected that the coal-carrying capacity will be increased to 1,450 tons. Besides affording additional protection to the engines and boilers from an enemy's gunfire, the distance which each vessel can be steamed at a 10-knot speed will be increased from 5,000 to 8,000 knots. To prevent any chance of mishap in the bunkers through the accumulation of combustible gases, the Admiralty state that it is to be clearly understood that the coal in the wings is not to be allowed to remain there in reserve for long periods, but it is to be worked out from there as well as from the ordinary bunkers. Similar arrangements are to be made in the 1st class cruisers of the "Edgar" class.

The new 2nd class cruiser "Hermione" has completed her steam trials satisfactorily. During her eight hours' natural draught run the contract I.H.P. of 7,000 was exceeded by nearly 400, and a speed of 19 knots was easily maintained. The mean results for the eight hours were:—Steam pressure in boilers, 140 lbs.; in engines, 136 lbs.; vacuum, starboard, 26·3 in.; port, 26·3 in.; revolutions, starboard, 128·6; port, 128·8; I.H.P., 7,393; speed by log, 19 knots, and air pressure, 0·45 in. The forced draught trial was not so satisfactory, for although the contract H.P. was exceeded by 264, the engines having developed 9,264 I.H.P., yet the corresponding speed for some unexplained reason was only 19·5, although the day was quite fine and the sea smooth. A Reuter's telegram from Vancouver reports that the "Royal Arthur," on her steam trial under natural draught between Callao and Coquimbo, maintained an average speed of 19·5 knots. This would appear to be a mistake, as more authentic information from the ship gives 18·5 knots as the average speed maintained. This result, however, is very good, and reflects great credit on the engineering staff of the ship.

France.—The following are the principal appointments which have been made:—Vice-Admiral Miot has been nominated conservator of the Naval and Ethnographical Museum at the Louvre; Rear-Admirals—Michel, as Chief of the Staff of the 5th Maritime Arrondissement (Toulon), and Rocomaure placed on the retired list; Capitaines de Vaisseau—Cochet, to command of "Sfax," Puech, as President of the Commission of Examination for Admission to the Naval-School for 1894; Manceron, as Examiner of the School of Pilotage for 1894; Fiessinger, as President of the Board of Examination for Engineers; and Saget de la Jonchère to "Friant;" Capitaines de Frégate,—Houette, to Ministry of Marine, for service on the General Staff of the Navy; Rossel, to command of "Surcouf;" Lecomte, to command of "Scorff;" d'Aboville, to command of "Lalande;" De Faubournet de Montferand, to command of "Cacique," tender to the School of Gunnery; Thesmar, to command of Défense-Mobile, at Brest; Lamson, as one of the Examining Board of the School of Pilotage for 1894; Saget, for service on shore at Brest, and Arnoux, as Inspector of Electric Semaphores, at Rochefort. ("Le Moniteur de la Flotte.")

The trials of the new 1st class armoured cruiser "Latouche-Tréville," of which we give the profile, deck plan, &c. (Plate 26), have not as yet proved so successful as was anticipated, various defects both in the engines and boilers having shown themselves, and the engines having failed to develop within 200 of the contract I.H.P. of 9,000. It is understood that the necessary repairs to the machinery of the new torpilleur-de-haute-mer "Lansquenet" will occupy at least three months, and she will be temporarily paid off at Brest until ready to resume her trials. The new 2nd class cruiser "Friant" has been commissioned at Brest for her trials. She is a sister ship to the "Suchet," which has lately successfully completed her trials and is now to be attached to the Reserve Division of the Mediterranean Fleet. ("Yacht" and "Petit Var.")

The "Marine Budget" for the year 1895 has now been issued to the Chamber: it amounts to 277,516,311 francs, an increase of 10,654,783 francs over the estimates of the current year; if, however, the increase of the subsidy to the "Caisse des Invalides" is not counted, the real increase is 9,220,783 francs. Chapter 1 shows

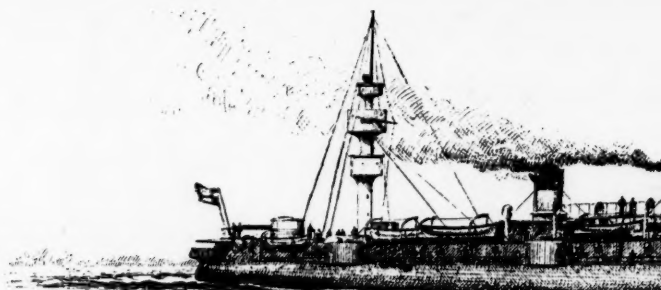
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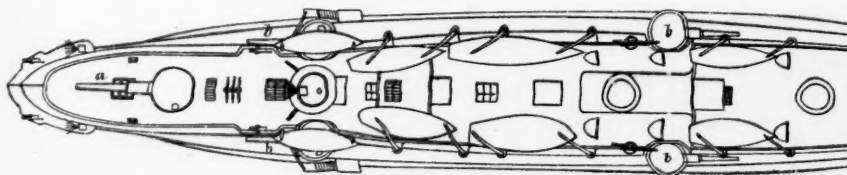
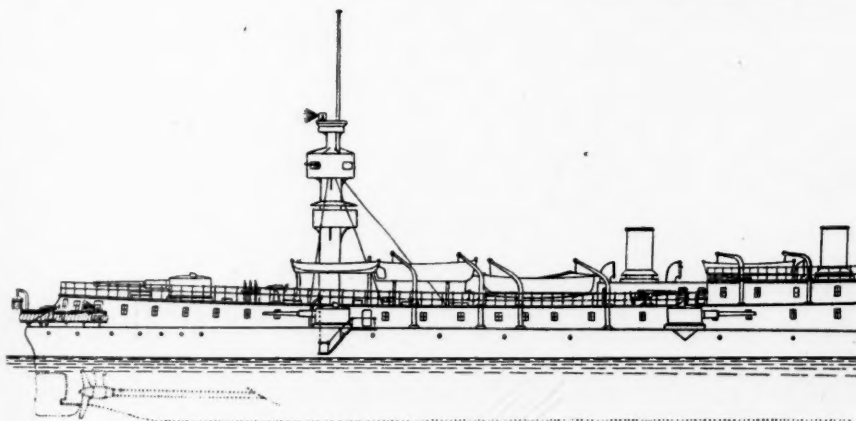
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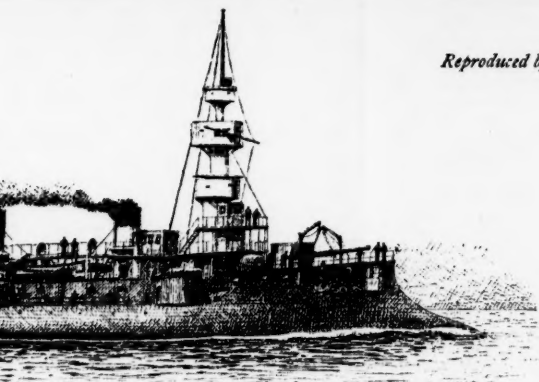
"LATOUCHE-TRÉVILLE"

4,750 TONS. 9,000 I.H.P. ON HE



NEW ARMoured FIRST CLASS CRUISER "LATOUCHE-TRÉVILLE." PROFILE AND DECK PLAN, SCALE

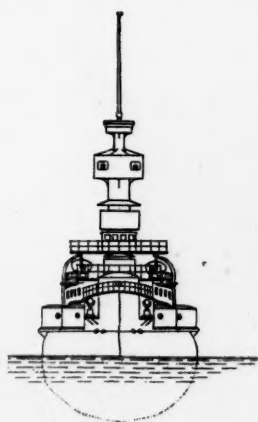
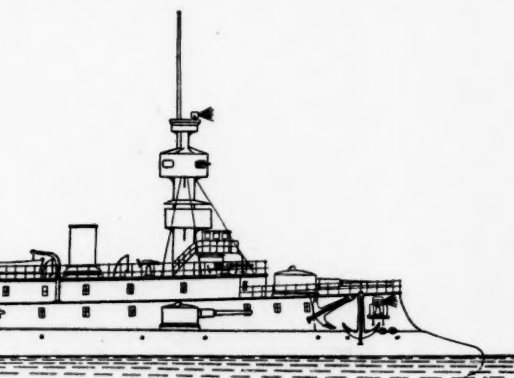
Reproduced by permission from Le Yacht.



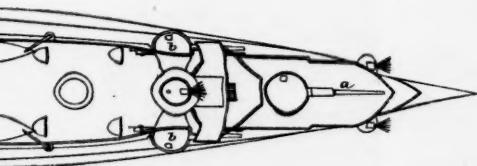
CLASS ARMoured CRUISER.

"LE TRÉVILLE."

1,100 H.P. ON HER TRIAL.



BOW VIEW



a. 19 cm. (7.8 inch) gun.
b. 14 cm. (5.4 inch) Q.F. gun.

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an increase of 65,000 francs, which is devoted to a new organisation of the command of the "troupes de la marine," a body of men who are really Colonial troops and have no direct connection with the navy as such; for the future they are to be placed under the command of a General of Brigade, instead of the Rear-Admiral the Director of the Personnel of the Navy.

Chapter 4.—Pay of Officers and men (42,702,857 francs) shows an increase of 1,318,674 francs, which is due to an increase of the effectives. Provision is made for 42,205 men as against 41,536 this year; of this number 34,182 are for service at sea, 4,155 on shore, 75 for ships in the 1st category of the Reserve, 3,793 in ships in the 2nd category of the Reserve. Provision is made for 1,842 officers, of whom 1,382 are for service at sea, 97 in ships in the Reserve, 346 for service on shore and 17 in Tonkin and Dahomey. The officers for service on shore include 12 vice-admirals, 23 rear-admirals, 35 capitaines de vaisseau, 83 capitaines de frégate, 83 lieutenants de vaisseau of the 1st class and 83 of the second; for service at sea there will be 3 vice-admirals, 7 rear-admirals, 56 capitaines de vaisseau, 104 capitaines de frégate, 250 lieutenants de vaisseau 1st class, 250 2nd class, 392 enseignes de vaisseau, 240 aspirants 1st class and 80 2nd class; there will be 274 engineer officers, of whom 189 will be at sea, 29 in ships in the reserve, 55 for service on shore, and 1 at Tonkin. Chapter 5.—Marine troops (13,075,302 francs) shows an increase of 1,308,405 francs, of which a large part is due to bounties on enlistment and re-enlistment. Chapter 8.—Technical personnel (2,050,719 francs) shows an increase of 7,717 francs. Under the heading of matériel, Chapter 23 is increased by 15,800 francs to a total of 252,600 francs. Chapter 24.—Naval constructions, coal, supplies, &c.—shows an increase from 13,357,925 to 16,000,000 francs. Chapter 27.—Naval constructions, new ships, and the first commissioning of new ships—shows an increase of 5,000,000, from 22,000,000 to 27,000,000 francs. Chapter 30.—Artillery, powders, and munitions—is increased by 430,338 francs. Chapter 33.—Hydraulic works, new buildings, and improvements—is increased from 4,239,325 francs to 5,422,685; the work to be carried out includes a third refitting basin at Toulon, and alterations to the basin No. 3 at Castigneaux, the dredging of the roadstead of Toulon which will cost 7,000,000 francs, and the deepening of the Charente. Chapter 34.—Extraordinary works of port defence—is increased by a million francs. There are reductions in three of the votes for the personnel, viz.: for gendarmerie, victualling staff, and medical and hospital service. Under the heading of matériel the following reductions appear:—Chapters 25 (contract-built ships) by 3,519,000 francs; 26 (contract-built ships, special chapter now being concluded) by 3,100,000 francs; 28 (artillery-establishment and reconstitution) by 500,000 francs; 31 (artillery-maintenance) by 677,873 francs; 32 (torpedoes) by 117,000 francs; 37 (provisions) by 21,641 francs.

(“Le Yacht” and “Moniteur de la Flotte.”)

The following is the contemplated composition of the squadrons for 1895.

The Active Division of the Mediterranean Fleet, battle-ships, 9:—“Amiral Baudin,” “Brennus,” “Courbet,” “Hoche,” “Dévastation,” “Formidable,” “Marceau,” “Magenta,” and “Neptune.”

1st class armoured cruisers, 3:—“Chanzy,” “Charner,” and “Dupuy-de-Lôme;” the last with full complement for six months only.

2nd class cruiser, 1:—“Chasseloup-Laubat,” full complement for six months.

3rd class cruisers, 4:—“Coëtlogon,” “Cosmao,” “Lalande,” and “Linois,” the last two with full complements for six months only.

Torpedo-cruisers, 3:—“Faucon,” “Vautour,” and “Wattignies.”

Torpedo-Avisos, 4:—“D’Iberville,” “Léger,” “Levrier” (full complement for eight months only), “Cassini,” full complement for four months.

Torpilleurs-de-haute-mer, 6:—“Ariel,” “Argonaute,” “Corsaire,” “Dauphin,” “Forban,” and “Mousquetaire,” and one Aviso, at Constantinople, the “Petrel.”

The Reserve Squadron of the Mediterranean. Battle-ships, 3:—“Colbert,” “Amiral Duperré,” and “Redoutable.”

Coast-defence battle-ships, 4:—“Caïman,” “Terrible” (these five ships with full complements for six months, and reduced crews for the other six months), “In-

domptable" (six months complete, three months *en disponibilité*), and "Tréhouart" (three months complete and three months *en disponibilité*).

Second-class Cruisers, 2:—"Suchet" and "Friant," six months with full complements and six months with reduced. Third-class cruisers, 2:—"Forbin" and "Milan."

Torpedo-Avisos, 2:—"Bombe," "Dague."

Torpilleurs-de-haute-mer, 4:—"Averne," "Dragon," "Flibustier" and "Tourmente;" these last eight ships with full complements for six months and reduced for the other six.

The squadron of the North:—

Battle-ship, 1:—"Suffren."

Coast-defence battle-ships, 5: of these the "Bouvines," "Jemmappes," and "Valmy" will be fully manned for the whole year, and the "Suffren," the flag-ship of the Commander-in-Chief, with the "Furieux" and "Requin," will have full complements for six months and reduced for six months; the armoured 1st class cruiser "Latouche-Tréville," the 3rd class cruiser "Surcouf," the torpedo-cruiser "Fleurus," the torpedo-aviso "Lance," and torpilleurs-de-haute-mer "Sarrazin" and "Archer" will be the other ships of the squadron with full crews for the whole year, while the 1st class cruiser "Isly," the 3rd class cruiser "Troude," the torpedo-cruiser "Épervier," torpedo-aviso "Salve," and the two torpilleurs-de-haute-mer "Chevalier" and "Tourbillon" will have full complements for six months and reduced for six months; the whole squadron will therefore consist of battle-ships, 6; 1st class cruisers, 2; 3rd class cruisers, 2; torpedo-cruisers, 2; torpedo-avisos, 2; and 4 torpilleurs-de-haute-mer.

The foreign squadrons will be thus composed:—

Flying and training squadron:

2nd class cruiser, "Nafade,"

3rd " " "Nielly," "Rigault de Genouilly."

Atlantic Division.—1st class cruiser, "Duquesne," 3rd class cruisers, "Villars" and "Beautemps-Beaupré." Aviso, "Hussard."

Pacific Division.—2nd class cruiser, "Duguay-Trouin."

3rd class cruisers, "Duchaffault" and "Fabert." Aviso-transport "Scorff."

China Squadron.—Battle-ship, "Bayard."

3rd class cruiser, "Forfait." Aviso, "Inconstant," and the gunboats "Comète" and "Lion."

Naval Division in Cochinchina:—Gunboats: "Lutin," "Caronade," and "Cimeterre."

Depôt-ship and vessels attached—"Européen" and six 3rd class torpedo-boats, of which two are in commission and four in reserve, also the following seven vessels in the reserve: battle-ship "Triomphante;" gunboats and dispatch-vessels, "Styx," "Alouette," "Aspic," "Vipère," "Baïonnette," and "Bouclier."

East Indian Division.—3rd class cruiser "Primauguet." Aviso "Papin." Aviso-transport "Rance." Gunboats, "Étoile," "Lynx." Depôt-ship, "Corrèze."

Vessels commissioned for special service:—One battle-ship, "Turenne," one 3rd class cruiser, "Éclaireur," one 1st class aviso, "Voltigeur," and one gun-boat, "Lézard." The above squadrons for home and foreign service are manned by 1,164 officers and 20,783 men, at a total cost of 45,900,121 francs.

The "Défense-Mobile" will be composed as follows:—

Cherbourg—One depôt-ship, four 1st class torpedo-boats and four 2nd class in commission. In Reserve, fourteen 1st class, fourteen 2nd class, and one 3rd class torpedo-boats.

Dunkirk—In commission, one armoured gunboat, the "Flamme," two 1st class torpedo-boats and two 2nd class.

Brest—In commission, one depôt-ship, two 1st class torpedo-boats, four 2nd class, and two 3rd class. In reserve, two 1st class, six 2nd class, and six 3rd class boats.

Lorient—In commission, one dépôt-ship, three 2nd class and two 3rd class boats. In reserve, two 1st class, five 2nd, and ten 3rd class boats.

Rochefort—In commission, one dépôt-ship, one 1st class, one 2nd, and three 3rd class boats. In reserve, four 1st class, five 2nd, and four 3rd class boats.

Toulon—In commission, one dépôt-ship; three 1st class, four 2nd class, and two 3rd class boats. In reserve, nineteen 1st class, twenty-one 2nd class, five 3rd class, and six vedette-boats.

Corsica—In commission, one dépôt-ship, four 1st class and four 2nd class boats.

Algiers—In commission, three 1st class and three 2nd class boats. In reserve, three 1st class and three 2nd class.

Bône—In commission, three 1st class and two 2nd class boats.

The following vessels are also to undergo their trials:—Battle-ships, "Charles-Martel," "Jauréguiberry," and "Lazare-Carnot;" Coast-defence battle-ship, "Tréhouart;" 1st class armoured cruiser, "Bruix;" 2nd class cruisers, "Bugeaud," "Chasseloup-Laubat," "Friant," and "Descartes;" 3rd class cruiser, "Linois;" torpedo-avisos, "Cassini" and "Casabianca;" the gunboat "Surprise;" one torpilleur-de-haute-mer, five 1st class and four 2nd class torpedo-boats, and the submarine-boat "Morse." ("Le Moniteur de la Flotte," and "Yacht.")

Germany.—The following are the principal promotions and appointments which have been made:—Captain Barandon to Rear-Admiral; Corvette-Captains Stubenrauch, von Eickstedt, and Wodrig to captains; Captains—Foss to "Gneisenau," Vallette to "Wörth," Hessner to "Friedrich der Grosse," Karl Galster to gunnery-school-ship "Mars," Boeters to "Deutschland," Sach for service at Ministry of Marine, Stubenrauch to be Governor of Heligoland, von Wiersheim to "Stein," Koch to "Moltke," Hugo von Schuckmann to command of 1st Seamen's Division, Oscar von Schuckmann to "Stosch," Herz to inspectorship of the coast district of the "Elbe, Weser, and West-Schleswig-Holstein," Herbig and Klaus as inspectors of the coast districts of "Pomerania-Mecklenburg" and "Friesland-Jade" respectively, and von Frantzius as chief of the Staff of the Baltic naval command:—Corvette-Captains—Hellhoff for service in the dockyard at Kiel, Wodrig to command of torpedo-school-ship "Blücher" and President of the Torpedo Trial Committee, Credner to "Marie," Zeye to command of torpedo-boat flotilla, Vüllers to "Pfeil," Köllner to superintendent of artillery dépôt at Wilhelmshaven, Meuss to "Wacht," Goetz to "Carola," von dem Groeben to "Seedler," Graf Ernst von Baudissin to "Iltis," Ehrlich to "Hildebrand," and Oelrichs, August Thiele, and da Fonseca-Wollheim for service with 4th class coast defence ships in the Reserve. ("Marine-Verordnungs-blatt.")

The following is the composition of the Manœuvre Squadron, under the command of Vice-Admiral Koester, who has Captain Fischel as his Chief of the Staff:—

1st Division.—Battle-ships: "Baden," flag-ship of Commander-in-Chief, "Bayern," "Sachsen," "Wurtemberg."
Dispatch vessel, "Pfeil."

2nd Division.—Battle-ships: "König-Wilhelm," flag-ship of Rear-Admiral von Diederichs, second in command, "Deutschland," "Brandenburg," "Friedrich der Grosse."
Dispatch vessel "Wacht."

The torpedo-boat flotilla, under the command of Corvette-Captain Zeye, is composed of two divisions, as follows:—Dispatch vessel "Blitz" as flag-ship. III. (A) Torpedo-boat Division.—Division-boat "1" and 1st class torpedo-boats "26," "27," "28," "29," "30," and "31." II. (B) Torpedo-boat Division.—Division-boat "8" and 1st class torpedo-boats "68," "69," "70," "71," "72," and "66." For the Reserve Torpedo-boat Divisions, viz., 1st, 5th, 4th, and 6th, the Division-boats "4," "3," "6," and "2" have been commissioned respectively, while three 1st class boats are commissioned at Kiel and three at Wilhelmshaven for training purposes, all under the command of lieutenants. The cruiser spar-decked corvettes "Stosch," "Stein," "Moltke," and "Gneisenau" are in com-

mission as training-ships, the two first for cadets, the two last for boys, but with a certain number of cadets on board in addition. On foreign service are employed at present, the 3rd class cruisers "Arcona," "Alexandrine," and "Marie," the 4th class cruisers "See-Adler," "Hyäne," "Bussard," "Falke," and "Sperber," the gunboats "Möwe," "Iltis," "Wolf," and the dispatch vessel "Loreley" at Constantinople. As training-ship for stokers, the 2nd class cruiser "Prinzess-Wilhelm," and as surveying-ship the "Albatross" are employed; the new 1st class battle-ship "Worth," and also the new 4th class coast-defence armour-clad "Heimdall," have been commissioned for their trials. ("Marine-Verordnungs-blatt.")

The "Wörth" is having her heavy guns mounted alongside the Germania Yard at Kiel; her sister-ship, the "Weissenburg," which is being completed at the Vulcan Yard at Stettin, is to proceed to Swinemünde about the middle of June to receive her guns, and will then be brought to Kiel. The new torpedo-avisos "Comet," which has been built at Stettin, is to proceed to Kiel to be commissioned for trials, as is also the new 4th class coast-defence armour-clad "Hagen," the sixth vessel of the "Siegfried" type to be completed. ("Kreuz-Zeitung.")

According to present arrangements the fleet to take part in the autumn manœuvres will be assembled at Kiel by the 1st August, and will be composed of the two divisions of the manœuvre-squadron, the composition of which we have already given, the 3rd division, to the command of which no officer has yet been nominated, is to be formed of the coast-defence battle-ships "Hildebrand," "Firthjof," "Beowulf," and "Heimdall," with the "Comet" as dispatch-vessel; 4th division, to command of which no appointment is yet made, will be the training squadron "Stein" (flag-ship), "Stosch," "Moltke," and "Gneisenau," to which the torpedo-depot-ship "Pelikan" will be attached as dispatch-vessel; 5thly, two torpedo-boat divisions, the first under the command of Corvette-Captain Zeye in the "Blitz," and the second (the reserve division) under the command of Corvette-Captain von Basse, composed in all of four division-boats and 24 1st class torpedo-boats.

The final manœuvres will, as last year, be carried out under the immediate direction of the commanding admiral of the navy, Admiral Baron von der Goltz, who will hoist his flag on board the gunnery-school-ship "Mars."

("Nord-Ostsee Zeitung.")

The new 3rd class cruiser "Gefion" has made a successful preliminary trial of her machinery, the course being between Danzig and Pillau. ("Kreuz-Zeitung.")

The following short details of the organization of the seamen on land may be of interest:—

Two "seamen's divisions"—the 1st at Kiel, the 2nd at Wilhelmshaven; each is commanded by a captain, who has on his staff a lieutenant as his adjutant, two doctors, and four paymasters. Each division consists, again, of two sub-divisions, which are commanded by corvette-captains, each sub-division having three companies.

Two "dockyard divisions"—one at Kiel and one at Wilhelmshaven, each composed of five companies; they are commanded by captains, with corvette-captains or lieutenants in command of the companies. The staff consists of a lieutenant as adjutant, 1 doctor, 3 paymasters, and 12 or 14 engineers.

The "marine infantry" is under the command of a colonel, and is composed of 2 battalions of 4 companies each, which are commanded by majors and captains. The first battalion is at Kiel, the 2nd at Wilhelmshaven.

The "marine artillery" there are 3 divisions, having 4, 3, and 4 companies respectively, which are stationed at Friedrichsort, Wilhelmshaven, and at Lehe (on the Weser). They are under the command of a Rear-Admiral, who also commands the gunnery-school, "Mars," and its tenders, the "Hay" and "Rhein," the artillery depôts, and the "fixed defences" with their personnel. The commands of the divisions and companies are held by corvette-captains and captain-lieutenants.

The Torpedo Division.—This division is made up of two sections, one at Kiel,

the other at Wilhelmshaven; there is a captain in command who has under his orders the torpedo school-ship, the torpedo factories, and the boats in commission for instruction purposes. Each section is divided into three companies, which are commanded by captain-lieutenants.

("Mittheilungen aus dem Gebiete des Seewesens.")

A new torpedo division-boat and eight boats of the 144 ft. in length and 26 knots speed type have been ordered from the Schickau firm at Elbing; eight boats which were ordered in 1892 have just been delivered at Wilhelmshaven. There are also under construction at Elbing, 16 of the 144 ft. type boats in addition to the 8 lately ordered; as soon as the new vessels are ready, the German Navy will possess 11 division-boats, and 120 1st class boats, of which 30 will have a speed of 26 knots, and 15 a speed of 24 to 25 knots. ("Kreuz-Zeitung.")

The 9th of May was the thirtieth anniversary of the naval action in the North Sea, off Heiligoland, between the Austrian and Prussian squadron, under the command of the late Admiral Tegetthoff, and the Danish fleet. The Austrian ships were the steam frigates "Schwarzenberg," of 52 guns, which carried the broad pennant of Commodore Tegetthoff, the "Radetzky," of 38 guns, and the gun-vessel "Seahound," of 6 guns; while the Prussian vessels were the paddle dispatch-vessel "Preussischer-Adler," of 4, and the gunboats "Blitz" and "Basilisk," of 2 guns each respectively. The Danish squadron consisted of the steam frigate "Niels Juel" and the corvettes "Heimdal" and "Dagmar," carrying between them 104 guns. The result of the battle was a drawn one, for although the Danes claimed that, but for the Austrian squadron being able to anchor in the neutral waters of Heligoland, they would have won a decisive victory, yet they nevertheless returned to Copenhagen and their squadron did not again put to sea during the war. The Austrians lost 34 killed and 105 wounded, and the "Schwarzenberg" lost her foremast, which was set on fire by a shell bursting in the bunt of the fore-sail; the Danish loss was 15 killed and 30 wounded; the Prussian loss was *nil*. The English frigate "Aurora," under the command of Sir Leopold M'Clintock, lay off Heligoland at the time to prevent any violation of the neutrality of the waters round the island. ("Kreuz-Zeitung.")

Netherlands.—The Marine Budget for the current year for the Netherlands Indies, which is distinct from the Naval Home Budget, amounts to 2,908,592 gulden for expenses incurred in Holland, and 5,008,325 gulden for expenses in the Indies; of this sum, 1,789,492 gulden is devoted to the "personnel" and 1,067,000 gulden for "matériel." The "personnel" for the squadron consists of 3,794 officers and men, of whom 2,378 are borne in the 21 ships on the station, and 1,416 in the auxiliary squadron of 4 ships. The crews are composed of 2,783 Europeans and 1,011 natives. The present condition of the squadron is given as follows: exclusive of 2 guard-ships, 3 surveying vessels, 1 torpedo-boat, and 2 steam yachts, the flotilla in the Indies consists at present of 1 armoured corvette, 16 smaller vessels (including the new vessel "Borneo," now nearly ready for sea), a 1st class paddle dispatch-vessel, and two 2nd class paddlers for river service. One of the guard-ships will, in a short time, be struck off the active list and will be replaced by a 1st class paddle vessel. Of the other vessels of the flotilla, two, perhaps four, will have to be condemned, as their state is very bad, in consequence of their long stay in Atchinese waters. Provision, however, is only made in this Budget for the building of one new vessel, as the details for a new arrangement of the squadron are still under consideration. The present organization dates from the year 1866.

("Marine-blad.")

United States.—The new 2nd class cruiser "Marble Head" has completed her final trials, which took place off Sandy Hook on May 1st and 2nd ult. The trial lasted 48 hours and is reported to have been very satisfactory; the two-hours speed trial, which began the test under natural draught, is stated to have given the best results, the average speed having been 17.3 knots per hour. There was no

pronounced vibration, and the engines worked well. "The Marble Head" is a small cruiser of 2,000 tons, 5,400 I.H.P., 257 ft. long, and a beam of 37 ft. She has two sisters, the "Montgomery" and the "Detroit," and their armament consists of two 6-in., eight 4-in. Q.F., and six 6-pr., and two 1-pr. Q.F. guns, with 6 torpedo-tubes. ("Army and Navy Journal.")

A very successful trial of 12-in. shot took place at Sandy Hook proving ground on March 29th. The expenses incurred by the Government and the manufacturers amounted to over \$17,000, the armour-plate alone, which was used as a target, costing \$12,600. The trial of the projectile was made with the 12-in. gun supplied by the Watervliet Arsenal, while the projectiles were made by the Midvale Steel Company, of Philadelphia, and the Carpenter Steel Company, of Nicetown, Pa. The new shot are 3½ ft. long, and weigh about 1,000 lbs. The heads are hardened by a secret process. The target was an oil-tempered, annealed, nickel-steel plate, made by the Bethlehem Steel Company. The plate was 13½ in. thick, 16 ft. in length, 9 ft. wide, and weighed 35 tons. In all, four shots were fired. The plate was set up 150 yds. from the gun, and the charge used was 355 lbs. of brown prismatic powder; the chamber pressure was 23,000 lbs. All the projectiles pierced the plate, which was cracked in all directions. The first shot (Carpenter), when dug out of the sand, was found to be broken, but the other shots were all uninjured. The heat generated by the force of impact on the plate was about 600° Fahr. The behaviour of the projectile was regarded as most satisfactory. ("Army and Navy Journal.")

The trial of one of the twelve 13-in. guns took place at the Indian Head proving ground on the Potomac, near Washington, on March 22nd ult. The 13-in. guns are the largest ever built in the United States, and are intended for the three new battle-ships, "Oregon," "Indiana," and "Massachusetts." The latest battle-ship, the "Iowa," will carry nothing heavier than 12-in. guns, which are likely to be the heaviest used in any navy in the future, in the opinion of the best Ordnance experts. The first forging for one of the new 13-in. guns was made in 1890, so that nearly four years elapsed before one of the guns was completed. The gun itself weighs 65 tons, and rests in a saddle weighing 10 tons, and is managed by means of hydraulic machinery. The rifling grooves are 52 in number, and give the shell a gradually-increasing rotation, until when it leaves the muzzle it rotates at the rate of 73 turns a second. The forgings for the big guns were made by the Bethlehem Ironworks, and the guns were finished at the Washington Navy Yard. The cost of one of these guns is about 60,000 dols., and every shot with a steel projectile, 700 dols.

An iron projectile weighing 1,100 lbs. was propelled by a charge of 403 lbs. of brown hexagonal powder. The velocity of the first projectile fired was 1,720 ft. a second. For the second and last shot the charge of powder was increased to 480 lbs., with the result of increasing the velocity to 1,975 ft. per second. It is estimated that with a charge of 550 lbs. of powder a muzzle velocity of 2,100 ft. per second would be produced, sufficient to drive an armour-piercing projectile through 23·42 in. of steel at 1,500 yds. ("Scientific American.")

The ingredients of the Leonard smokeless powder, according to the patent specification, for the United States 30-calibre rifle, are given as follows:—

150 parts by weight of nitro-glycerine.

50 " " " gun-cotton.

10 " " " lycopodium.

4 " " " finely-triturated urea crystals, but the proportions are varied according to the calibre of the gun which is to use it.

If dinitrobenzyl be employed in the manufacture instead of finely-triturated urea crystals, a similar quantity, namely, four parts, should be used. The several ingredients named above are first mixed together, and there is then introduced

as a solvent either acetone alone, or acetone combined with acetate of amyl, or acetone combined with acetic ether.

The solvent is evaporated by agitation, and the material is formed into a cake or granules by pressing in moulds. The analysis of cordite, which we give for the sake of comparison, is as follows:—

Gun-cotton, as previously used at Waltham Abbey	37 parts.
Nitro-glycerine	58 „
Vaseline.....	5 „

Total..... 100 „

The solvent here used is again acetone, the proportion being 19·2 parts. The mixture is incorporated for 3½ hours, and is then squeezed into threads. If the “scouring” and “pitting” actions which accompany the use of cordite are obviated in the Leonard powder, a bright future is before it.

(“Scientific American.”)

MILITARY.

Home.—Herr Dowe's and Mr. Maxim's Bullet-proof Cuirasses.—As this journal penetrates far beyond the sphere of the ordinary daily press, a short summary of the progress of these inventions may be of service.

On Wednesday, the 23rd May, the management of the “Alhambra” succeeded in collecting an audience embracing some five-sixths of the expert talent of the army to witness the first exhibition of Herr Dowe's cuirass in England. A committee was formed from the officers present consisting of Admiral Saumarez, Captain Dutton Hunt, Captain Cowan, R.E., and Mr. Lowe, 1st Westminster Rifles. Captain Dutton Hunt brought his own cordite cartridges direct from the Guards' magazine, and a Lee-Metford rifle. Captain Martin, Herr Dowe's colleague, produced a Mannlicher—German service pattern—and its proper ammunition. The rifles were first fired for penetration against a log of elm 2 ft. 4 in. thick, placed with the fibre lengthways, and both the weapons demonstrated their power of piercing it, the German rifle showing a slight superiority. The cuirass, a pad like the cushion of a 1st class railway carriage, measuring about 14 in. by 16 in. in surface, 2 in. in thickness, and weighing 11½ lbs., was then produced, and having been placed leaning against the elm log, satisfactorily stopped all bullets—one or two rounds being fired by Captain Dutton Hunt himself. A horse was then led on to the stage with a four-fold blanket strapped on by a surcingle; to this the pad was attached so that it appeared to be in contact with the curve of the ribs. A shot was then fired at the target, and the horse never winced, did not even move its feet, proving that the energy of the bullet was practically arrested. All suspicion of juggling with the cartridges was put at rest next morning by a letter in the “Times” from Captain Dutton Hunt explicitly denying that anything of the kind had taken place.

One point deserves attention—a single round struck a few inches from the edge of the pad, and splinters of material were driven out laterally through the covering.

Since then Herr Dowe has himself worn the cuirass and been fired at under test conditions without injury, the only point to notice being that he holds the lower edge in his hands apparently slightly away from his body. The shock does not move his feet.

On Thursday, the 31st May, Mr. Maxim wrote a jocular letter to the “Times” and other papers, announcing that he had invented a rival cuirass, and inviting everyone to his works at Erith next day to see it. Some 800 accepted, but no proper arrangements being made for this crowd the day was unsatisfactory to everyone. The crowd interfered with Mr. Maxim, and Mr. Maxim did not understand how to manage the crowd; he ultimately wore out their patience, and the

majority lost their tempers, and left by the next train. None the less, Mr. Maxim's shield, substantially lighter than Herr Dowe's, effectually stopped the bullets, but it was not tried on a living target, and the blow transmitted to the dummy seemed appreciable. Two shields were submitted to trial, and, under continued firing, the second broke up and revealed a plate of nickel steel. To this both the spectators and the press objected, though on what grounds it is not easy to see. Mr. Maxim had undertaken to stop Service bullets with a cuirass or pad substantially lighter than Herr Dowe's, and had distinctly succeeded.

Subsequently a good deal of correspondence has taken place, Mr. Maxim asserting that on practical engineering grounds, and by the indications afforded by the round mentioned above as having driven splinters of material outwards, he was convinced that Herr Dowe's coat contained a metal plate, and Herr Dowe and Captain Martin as positively asserting that it does not. For the moment the matter rests here.

Herr Dowe has at least demonstrated that it is possible to construct a pad which shall absorb 2,000 foot-pounds of energy laterally and not transmit any appreciable fraction to the man wearing it. This we implied in a previous note to be impossible, judging, as did Mr. Maxim, from the known ultimate cohesion of the molecules of any material which could be classed under the headings "cloth" or "fabric," and this we consider a remarkable feat indeed.

In our note in the last number of the Journal it was not stated that the blow of the Lee-Metford bullet would necessarily lift a man 10 to 14 feet, but in order to indicate the intensity of the energy to be absorbed or transformed, that energy was calculated out according to the ordinary formula, and the result stated in foot pounds, and that 2,000 foot pounds, if properly applied, will lift 200 lbs. 10 ft. or 10 lbs. 200 ft. in a second of time, is a fundamental proposition of elementary mathematics that no one will deny, though practically the rule cannot always be literally applied, for the action of a projectile is never "instantaneous" in the exact meaning of the word, but always requires a perceptible fraction of time. The practical problem really is to find some material which will conduct away from the point of impact by molecular disturbance laterally the energy successively delivered by each infinitesimal lamina of the projectile, more rapidly than the succeeding lamina can arrive, and we believe we are correct in stating that the precise solution of the problem is still beyond the range of practical mathematicians.

The Hollow Road of Ohain.—Pictures sometimes live longer than books, and eventually become accepted as evidence of fact, particularly where the painter has acquired a reputation for minute attention to details. The picture hung in this year's Academy under the above title induces us to offer a word of warning against the acceptance of this kind of second-hand evidence. It represents some French lancers plunging violently, like the swine, which Professor Huxley recently dragged into notoriety, down a steep place, and perishing in the abyss. The painter evidently drew his inspiration from Victor Hugo's "Les Misérables," and he will probably be both pained and surprised to learn that no such formidable obstacle ever existed on the field of Waterloo.

A hollow road of that name there certainly was, but, as an obstacle to trained cavalry, it was so insignificant that no reference whatever is made to it in letters from British cavalry and artillery officers who crossed it at different places repeatedly during the day. It neither checked them nor would it, even if it still existed intact, check a modern cavalry regiment of any country at any speed for more than a moment.

Whilst on this subject we would call attention to two of Meissonier's pictures now widely disseminated, and which have been referred to in our presence as evidence of fact, viz., "1809" and "1806;" in both Napoleon is represented on a big 16-hand horse, and on both occasions, as a fact, he rode "Marengo," a 14-hand Arab, whose skeleton stands before us as we write.

Moreover in "1809" the French cuirassiers are represented in wild disorder galloping. We do not deny that they some times did "run away to the front at a gallop," as Prince Hohenlohe describes it, but it was their special pride to charge as a rule with well closed files; and we have the special testimony of a cavalry

officer present who watched them with the keenest eyes—it was Graf von Bismarck, the Wurtemberger not the Prussian—to the effect that on this particular occasion they actually did maintain their order and the trot; so much for Meissonnier's accuracy.

War subjects cannot be considered as beautiful in themselves under any canon of art, and the sole justification for their perpetration lies in their historic value as memorials of a gallant act, and that adherence to historic truth will not render them any less attractive is sufficiently proved by the evidence of many in the Berlin collections, notably in the case of the charge of the Grey Chasseurs d'Afrique on the plateau of Floing (1st September, 1870), of Du Preuils' brigade against the 52nd Pruss Infantry in the Flavigny hollow 16th August, and of the 13th Uhlans in the great cavalry duel north of Mars-la-Tour on the same date; both the latter are in the mess rooms of the respective German regiments.

Austria-Hungary.—The following details of a severe winter march are taken from the "Russki Invalide." Two field batteries of the 1st Regiment were ordered to change quarters from Cracow to Wadowics, distance 33 miles, road mountainous. They left Cracow 15th January, the thermometer marking =22° Fahr., first stage 19 miles. Next day the temperature fell to -10, and in the mountains thick snow, a gale of wind, and a still lower degree of cold had to be encountered. Extra clothing had been served out, woollen gloves, flannel waist clothes, &c, and the batteries reached their destination with no worse casualties than a few frost-bitten ears amongst the men.

Belgium.—We are indebted to Captain Hutton (late K. D. G.'s) for the following interesting account of the visit of an English team of swordsmen, under his guidance, to Brussels. The matter is of special interest, as, until Captain Hutton took up this question of swordsmanship, English representatives of the art did not attract much public attention abroad—not even in their own country.

The Fête d'Armes at Brussels.—The Monnaie Theatre was on the evening of Monday, May 21st, the scene of the most complete and most important exhibition of the art of fencing that has ever yet been placed before the public. Under the title of "*L'Escrime à travers les Ages*" it exemplified, in some 10 different encounters, the methods of fighting, ranging from the fierce barbarous work of the 7th century to the refined delicacy of the modern *Salle d'Armes*, while to bring the various epochs of the sword more vividly before the audience, each event was made the central attraction of a "tableau," not as we understand it, a mere picture composed of living people, but a short graphically written tragic scene, in the dramatic part of which the best actors in Belgium gave their aid, while the accompanying music, some of it dating from the actual periods represented, was compiled by several of the foremost composers of the country.

The conception of this brilliant spectacle was originated by a committee of editors of the leading Brussels newspapers, who placed the arrangement of the mimed portion in the hands of the *Cercle d'Escrime*, whose president, M. Albert Fierlants, has a high reputation both as an author and as a swordsman. The main difficulty which presented itself to the joint committee lay in the accurate reproduction of the methods of early fencing, and, to overcome this, they invited the co-operation, not of the Continental experts, but of the English ones; the studies of Captain Hutton, F.S.A., and Captain Cyril Matthey, L.R.B., in ancient fence were well known to M. Fierlants, and it was to them that he applied for the required aid, and they selected a small party of six, the cream of the School of Arms of the London Rifle Brigade, including Lieutenants Stenson Cooke and Whittow, Private W. P. Gate, and a very clever young cadet, Mr. E. D. Johnson; the English team were the guests of M. Fierlants and the *Cercle d'Escrime*, by whom they were entertained throughout their visit of nearly three weeks with true Belgian hospitality.

The first "tableau," the "*Jugement de Dieu*," is a "combat à outrance" of the 7th century, in the presence of King Childebart and his Court, the champion being Rupert d'Angis (Captain Hutton), who had accused Gunther de Bontellier,

the King's Chamberlain, of having killed an ox, the property of his Majesty, which was in those days a capital offence; this latter being a very old man was allowed a proxy in the person of his nephew, Eric (Captain Matthey), who, after a ferocious encounter with double-edged broadswords and round shields, succeeded in hamstringing his enemy with the blow known in after times as the "Coup de Jarnac."

An entre-acte was now played in the form of a combat with two-hand swords by Lieutenant Cooke and Private Gate, which introduced the audience to the methods of the 15th century.

The second tableau was to a Belgian audience the most interesting of the whole series, representing as it did a contest in the lists between the great Flemish hero, Jacques de Lalaing (Captain Hutton) and Thomas Qué (Captain Matthey), an English esquire, who had crossed the sea on purpose to try his strength against him; the combatants wore complete armour, and fought with battle axes; Lalaing received a wound in the left wrist which paralysed his hand, and, finding himself rapidly becoming unable to maintain so unequal a contest, charged his opponent, striking him with the "tail" of his axe under the right arm as he was in the act of preparing a tremendous blow, and then immediately seizing him by the back part of his helmet, dragged him forward with such force as to cause him to fall forward, and his armour was so heavy that he was unable to rise again; the Flemish knight was, therefore, proclaimed the victor.

The third tableau, "Fantaisie Venitienne," was written up as a frame to two encounters between two patricians, Fabio (Lieutenant Whittow) and Lorenzo (Private Gate) with the "Case of Rapiers," and between their two servants, Beppo (Mr. Johnson) and Petruccio (Lieutenant Cooke), with poniards and cloaks.

The fourth is again historical, being an incident in the career of Alessandro Farnese, in which that prince (Captain Matthey), armed with short sword and dagger, rid Piacenza of a pest in the shape of the bravo Matteo il Birbone (Lieutenant Cooke), having previously disposed of his subordinate ruffians.

One of the most attractive fencing bouts was the combat at the end of the Henri III tableau, between three of the King's party and three of the Guises, in which all the English fencers took part, and in which a judicious arrangement was made in the costumes in order that a specially constructed fencing mask might be worn.

The sixth tableau, in the days of Richelieu, led up to a very graceful encounter between two musketeers, Villequier (Lieutenant Whittow) and Saintrailles (Private Gate), with rapier and cloak, underneath the very notice containing an edict of Louis XIII and Richelieu prohibiting the duel under pain of death.

The seventh, a very pretty Watteau scene, served to introduce a duel with "Colichemardes" between MM. Dupont and Selderslach; and the eighth, a representation of the famous fencing match between the Chevalière d'Eon and M. de Saint-Georges, in London, in the presence of the Prince Regent, Madame Gabriel being the d'Eon and Mons. Gabriel the Saint-Georges; it is a curious fact that both husband and wife are left-handed.

The performance ended with a scene in a modern Salle d'Armes, in which an admirable bout with the foils was played by Mons. G. Rouleau, of Paris, and M. Selderslach, of Brussels.

The fencing throughout was both brilliant and picturesque, and the costumes and mounting of the scenes magnificent, and we regret that want of space prevents our describing it more in detail. The libretto, an elegantly illustrated little volume, is published by Iebegue et Cie., of Brussels.

France.—Railways in Senegal. A detachment of twenty-four volunteers from the 5th Régiment du Génie have left Versailles to supervise the construction, by native labour, of the railway from its present terminus at Kayes to Segu, where the Niger becomes navigable. The distance is 400 miles, and no physical obstacles of magnitude are expected. When completed, this line will bring Timbuctoo within four days' journey of the coast. ("La France Militaire.")

The manœuvres between the 1st Cavalry Division and a combined division formed of the brigades of three Army Corps will be directed by General Baillood, and will take place between Evreux and Beauvais, on the plateau between the Eure and Oise.

According to the new French Infantry Instructions in each squad, two men are to be specially selected and educated as scouts, which will give 32 scouts per company in war. This is an idea first mooted by von der Goltz, in Germany, and has much to recommend it.

The great artillery manœuvres at the camp at Châlons will take place from the 11th to 22nd August. ("Revue du Cercle Militaire.")

It is announced that two reserve cavalry regiments will be called out in September (date not yet fixed) and be mounted on requisitioned horses. ("Spectateur Militaire.")

In future no remounts are to join cavalry or horse artillery under five years of age. The numbers required for the current year are:—For 13 cuirassier regiments, 1,118; 31 dragoons, 2,546; 21 chasseur and 14 hussars, 2,874; 6 Chasseur d'Afrique and 4 Spahis, 605; 22 horse batteries, 434. Grand total, 7,577. ("Revue de Cavalerie.")

Germany.—According to the "Kreuz Zeitung," the diminution in weight carried by the infantry, anticipated from the new order of 27th January, 1894, will amount to 15·4 lbs., English.

Italy.—There will be no grand manœuvres this year for the army, except for the Alpine companies; the Reserves called out will be only drilled in their garrisons. The Alpine companies will assemble in two bodies, which will manœuvre from the 28th July to the 10th August, one on the east, the other on the western frontier, the latter being the strongest. They will be reinforced by the Reservists of the 1st category of the class of 1868, and, in addition, Alpine companies will be formed of the mobile Militia and the territorial Militia from the Reservists of the classes 1858, 1859, 1860, 1861, 1862, 1863, and 1864. The men will be called out for 20 days, and will receive the new rifle model 1891.

("L'Avenir Militaire.")

Russia.—*Winter Manœuvres near Warsaw* (from the "Revue Militaire de l'Etranger").—These manœuvres are looked on as part of the necessary moral training of the troops—to stiffen them by the recollection of hardships overcome and privation endured. All three arms take part, and they last for two days with a bivouac between. The weather must be cold and dry, but extremes are avoided. This year they took place on the 21st and 22nd February, and in all 14 battalions, 12 squadrons, and 36 guns were employed in them. The recruits, at this date, not being sufficiently trained to take their places in the ranks, are formed in special detachments and allowed to look on in reserve. The temperature varied from 21·2° Fahr. in the day, 6·8° Fahr. at night, and there were no casualties to be deplored, thanks to the excellent arrangements for food and extra clothing.

Long Distance Race by Officers of the Guard Cavalry.—On the 27th February, 11 officers of the guard cavalry started to ride from the Moscow Gate, St. Petersburg, to Gatchina and back; the total distance was 100 versts = 66½ miles, both weather and roads in good condition. The best performance was 7 hours 17 minutes, and the worst 9 hours 19 minutes, which gives an average of about 8 miles an hour. The horses which finished in best condition were an English Arab stallion, a half-bred English horse, and an Arab mare, the worst was a Don Cossack horse. This performance compares very poorly with the average German pace for these distances, the best record for which is, we believe, Captain Lumley's

(13 Uhlans) 120 miles from Munster to Hannover, in 11 hours, 20 minutes. Von Reitzenstein and Starhemberg both averaged 5.5 miles an hour throughout, for the 385 miles, part through mountainous country, from Vienna to Berlin. In Australia and the Cape 100 miles in 10 hours has often been ridden, and as a basis of comparison with the Indian country-bred we would instance 52 miles in 5 hours 20 minutes from Regi, near Quetta, over the Ghaziband pass, by Gulistan to the mouth of the Kojak tunnel. The point of departure was 5,400, and of arrival 8,700 ft. about, above sea level, lowest level at Lora crossing half way, about 4,200, weight carried 12 stone, and heat (11th August) tremendous.

Sweden.—A new drill book has been worked out by the War Ministry and will be practically tested this summer. It is hoped that it will lead to great economy of the scanty time available for training and improved efficiency. From personal observation we can add that the degree of steadiness secured even under existing circumstances is quite astounding, and we can only wonder that our own auxiliary services have not devoted more attention to their methods.

The first line is now about to receive a 6.5-mm. rifle.

Switzerland.—*The Fortifications of St. Maurice, Vote for 225,000 fr.*—The works for the defence of St. Maurice (Valais) are completed. The casemates being too distant one from the other and too uncomfortable for men in time of peace, the Federal Council has asked for a vote of 30,000 fr. from the Federal Assembly for the construction of huts for 160 men. 150,000 fr. are also demanded for the maintenance and care of works and armaments from the 1st June to the 31st December, 1894. 45,000 fr. are required for the purchase of barrack equipment. The personnel entrusted with the maintenance of the works and armaments will be 1 artillery officer in command, 1 ordnance store officer, 1 paymaster, and 1 commissary; 3 N.C.O.'s attached to the latter, 2 mechanics, and 20 men, the pay for the latter being 5 fr. a day. ("L'Avenir Militaire.")

The following work has been done last year on the defences of the St. Gothardt:—The flanking galleries of Fort Airolo completed, armed, and handed over. The work at the Hospice finished in the rough and partly armed. At Andermatt the casemates all completed, and electric communications established throughout. The works on the Furka far advanced and the principal one of the group armed. at Göschenen, magazines, railways, and ramps completed, and for the whole, armament maps and range tables have been supplied. The railway over the pass and through the tunnel has now been doubled throughout. The Defence Commission is now busy with the projects for the protection of the Grimsel and of the district about Luziensteig—Sargans—Ragatz.

The effectives for the present year are: First line, 134,932; Landwehr, 80,298; Landsturm armed, 61,859; unarmed, 211,437. Grand total, 488,526.

FOREIGN PERIODICALS.

NAVAL.

Mittheilungen aus dem Gebiete des Seewesens.—Vienna and Pola. No. 6. "Electric Search-lights at Sea." "Electric Gun Fittings, with description of the Electric Fittings for Working the Guns and Steering Gear on board the Battleship 'Tegetthoff.'" "The Torpedo Organization and Coast Mobile defence in France." "The German Naval Budget for 1894-95." "Foreign Naval Notes."

Revue Maritime et Coloniale.—Paris. May. "History of the Port of Lorient, 1803 to 1809." "Naphtha Trials in Torpedo-boat 104," translation of M. Cuniberti's article in "Rivista Marittima." "Obock and Abyssinia"—(*conclusion*). "The new American Cruiser 'Columbia.'" "Influence of Sea Power on History," translated from Captain Mahan's work. "Foreign Naval Chronicle." "Report on Sea Fisheries."

Le Yacht.—Paris. 5th May, 1894. "The Budget Commission; Enquiry into the Navy" (E. Weyl). "The Shifting of Gravity due to Rapid Movements of Ships and Sea-sickness." "Naval Chronicle." 12th May. "The Naval Budget of 1895" (E. Weyl). "Naval Chronicle." "The Shifting of Gravity due to Rapid Movements of Ships and Sea-sickness"—(*continued*). 19th May. "The German Naval Budget" (E. Weyl). "Yachting in England and America." "Home and Foreign Naval Chronicle." "The Shifting of Gravity due to Rapid Movements of Ships and Sea-sickness." "A new Model for a Ship." 26th May. "The Depositions before the Commission of Enquiry into the Navy" (E. Weyl). "Report on the 'Magenta.'" "Trials of the Aluminium Yacht 'Vendenesse.'" "Naval Chronicle."

Marine de France.—Paris. "The Question of Newfoundland and the Arguin Banks" (Rear-Admiral Reveillère). "Corsica within Five Hours of France." "The Naval Quadruple Alliance." "Naval Chronicle." 12th May. "Naval Commands and the Administration of the Fleet." "The Enquiry at Toulon into State of the Fleet." "The Navigation of the Seine between Paris and Havre." "Paris a Port for Coast Trade." "Naval Chronicle." 19th May. "Wanted: A Better Type of Battle-ship." "The Atlantic and Mediterranean Canal." "Our Battle-ships as Judged by the Admiralty." "Naval Chronicle." 26th May. "Extra Parliamentary Enquiry into State of Navy." "The Navigation of the Seine between Paris and Havre"—(*continued*). "Naval Chronicle."

Le Moniteur de la Flotte.—Paris. 5th May. "The Iceland Fishermen," "Statistics of Shipwrecks in 1892." "General Assembly of the Central Society for Saving Life at Sea." "Naval Chronicle" (Home and Foreign). Appointments, &c. 12th May. "A Ball in 1806 at the Ministry of Marine." "The Budget for 1895." "The Extra Parliamentary Inquiry into the State of the Navy." "Naval Chronicle" (Home and Foreign). Appointments, &c. 19th May. "Battle-ships and Cruisers" (M. Landry), (5th article). "Statistics of Shipwrecks in 1892." "The Extra Parliamentary Inquiry into State of the Navy." "Naval Chronicle" (Home and Foreign). Appointments, &c. 26th May. "The English Admiralty." "The Extra Parliamentary Inquiry into the State of the Navy." "Naval Chronicle" (Home and Foreign). Appointments, &c.

Marine Rundschau.—Berlin. May, 1894. "History of H.M.S. 'Danzig.'" "On Lead-poisoning on board Ships of War." "Notes on Foreign Navies." "Statistics on German Deep Sea Fisheries." "The Behaviour of Torpedo-boats 68 and 69 in Bad Weather in the North Sea." "Aluminium-wire Hawasers." "On the Machinery for Self-acting Closing of Watertight Doors." Promotions, Appointments, &c.

Rivista Marittima.—Rome. May, 1894. "Naval Strategy" (D. Bonamico). "Electric Ventilators" (2nd article). "Torpedo-boats in a General Action." "The Administration of the Personnel of the Fleet." "Foreign Naval Notes." New Publications.

Rassegna Navale.—Rome. No. 3. "On the possible improvement of the machinery for Steamboats." "Application of Gauss's Logarithms for the Solution of some Formulas in the Art of Navigation." "Explosions in Steam Boilers"—(*continued*). "The Necessity of Supporting the Merchant Navy." "On the corrosion of and Deposits in Boilers"—(*continuation and conclusion*).

Revista General de Marina.—Madrid. May, 1894. "Description of the Turrets of the Battle-ship 'Pelayo.'" "Official Report of the Naval Section at the Chicago Exhibition." "The Importance of Geography as a Science." "The Cruise of the 'Clover.'" "Vocabularies of Powders and Modern Explosives"—(continued). "A Survey of the Construction of Fire-arms" (with plates).

Morskoi-Sbornik.—St. Petersburg. March, 1894. "Astrological, Magnetic, and Hydrological Observations in the Arctic Ocean in 1893." "On the Movements of Fluid in Pipes." "The New English Battle-ships and 1st Class Cruisers." "Naval Artillery in the United States."

The United Service.—Philadelphia. June, 1894. "The Engineer Corps of the United States Navy." "Our Sister Republics." "Origin and Development of Steam Navigation." "The Landing at Vera Cruz." "A Summer Among the Seals"—(continued). "The Dandy Boson." "Naval and Military Notes." "Service Salad."

For further articles on naval matters, see "Jahrbücher für die Deutsche Armee und Marine." June. "The German Fleet and the Reichstag" (Vice-Admiral von Henku). *Neue Militärische Blätter*. May. "The Japanese Navy." *Revue de Cercle Militaire*, No. 22. June. "A Study of Naval Tactics."

MILITARY.

Journal and Proceedings of the United Service Institution of New South Wales. 1893. Vol. v.—"A new Dial for indicating Ranges in Coast Defence," Captain J. S. Wigram, 2nd Garrison Division Artillery. "Modern Coast Defence," Captain W. T. Bridges, Instructor of Gunnery. "On the Organization, Equipment, and Training of a Federated Medical Service," Brigade-Surgeon Lieut.-Colonel W. Williams, P.M.O. "Infantry Attack Formations and Fire Discipline," Captain W. Bayly, Adjutant 2nd Infantry Regiment. "The Military Art of the Romans," by Arthur Galton, private secretary to H. E. the Governor.

U.S.A.—The United Service.—"Official and Social Etiquette" (Hamilton). "The Albemarle in Albemarle Sound" (Bennett). "The Principles of Strategy" (Wisser); review of Bigelow's work. "Recollections of MacClellan among our Contemporaries" (Shippen). "Notes."

Journal of the Military Service Institution.—"Coast Defence" (Brig.-Gen. Abbott). "A South American Revolution" (Lieut. Sears, U.S.N.); a short and readable study of the Chilean war. "Transport of Troops and Supplies" (Genl. Holaberd). "Infantry Foot-wear" (Lieut. Phister). "Military Hand-litter" (Major Hoff). "Post Records" (Lieut. Hine). "Training Drivers for Field Artillery" (Lieut. Hogle). "The Post Mess" (Lieut. Clarke). Comment and Criticisms:—I. The Management of a Post Hospital; II. The Corps of Engineers; III. The Quartermasters' Department. IV. Is the Three Battalion Organization the Best One for Us? Translations. "A General Review of existing Artillery" (Capt. Moch). "Cavalry in Future War" (Capt. Rawolle); well worth reading. "Field Fortification for the German Army," with diagrams (Lieut. Patterson). Reviews and Exchanges. "Great Commanders—Genl. Scott." "Modern American Pistols and Revolvers." "Annual Report of the Commandant U.S. Cavalry and Light Artillery School." "Two Views of Waterloo." Prize Essay; subject for next year. "Discipline." Historical Sketches. "Judge Advocate General's Department." "The Sixth Regiment of Infantry." "The Eighth Regiment of Infantry."

Organ der Militär-Wissenschaftliche Vereine.—No. 6. Vienna. "The Dog trained for War." "The Surprise of Colonel Wukassowitch at Dego, 1796;" worth the attention of students of Napoleon's great Riviera campaign in that year. "Water Filters." The list of lectures delivered under the direction of the Society

in different garrisons should be noted, 280 in all, dealing with every variety of tactical and strategical questions.

Mittheilungen über Gegenstände des Artillerie- und Genie-Wesens.—No. 5. Vienna. "Coast Defences;" a readable article by von Leithner, Lieut.-Col. K.K. Engineers. "Mechanical Time Fuzes;" valuable paper, with 5 plates, by Pangher, Capt. K.K. Artillery. "New Ballistic Tables" (Col. von Wuich). "Experiences with Rolling-stock, and Construction of 60-cm. Railways by the Prussian Railway Brigade;" very valuable. Fairley type of engine and bogie-trucks recommended. "Effect of Temperature on Tensile Strength of Steel;" strength increases up to 500° F. "Gas-retaining qualities of Materials for Balloon Construction."

Journal des Sciences Militaires.—May. "Dernier Effort." General Philebert gives some examples of his practice in previous manoeuvres. "Discipline, Subordination, and Exterior Signs of Respect," by General Dragomiroff. "The Pontoneers and their Proposed Suppression." "The 6th Corps and the 'Covering' Troops," compare "Militär-Wochenblatt," "The Duplication of the 6th French Army Corps," in No. 46. "Rôle of the German Cavalry Division, from the 8th August to 1st September, 1870." "The March of Large Masses of Infantry within Striking Distance of the Enemy." Worth study. "The Campaign of 1814" (Weil). "The Conception of Victory" (Droien).

Revue Militaire de l'Étranger.—May. "The Trans-Siberian Railway." Interesting, yet the author, who is certainly no pessimist, does not recommend it as an investment, and, as regards its military value, points out that to concentrate 100,000 men on the Ossourie would require five to six months, and in Transbaikal two months more. "The Spanish Army according to the Reorganization of 1893."

Revue des Deux Mondes.—June. "Italy in the Triple Alliance" (M. Charles Benoist). Review of Luigi Chialas' "Pagine di Storia contemporanea dal 1883 al 1892." Worth attentive consideration.

Spectateur Militaire.—15th May. "L'École Polytechnique" (Samion). "The Justification of the Cry for Numerical Superiority." "Observations on the New Regulations for the Manœuvres" (Brun). "Choses Graves," a call for enquiry into alleged acts of bullying in the French Army; interesting, as proving that a certain percentage of these brutalities take place even in the best regulated establishments.—June. "Disarmament and Armaments," a sensible article concludes disarmament Utopian. "The Justification of a Numerical Superiority"—(continued).

L'Avenir Militaire.—1st May. "Our Reserve Officers." Practical suggestions for their improvement. Read. "The Troops for the Sahara." "Pay of Captains." "Position of the Veterinary Surgeons." 4th May. "Our Reserve Officers," II. "The truth about Dongoi" states that "it is now certain the despatches were tampered with." "Russia and the taking of Algiers," showing cordial support of Russia at the date of the undertaking, 1830, and England's vain opposition. 8th May. "General Ferron," obituary. "The Comedy of the Pontoneers." 11th May. "Tous Dispenses," sarcastic leader on the request of the pupils of the various Government Schools of Chemistry, Physics, Ponts et Chaussées, &c., for exemption from military service. 13th May. "New Formations of Artillery." "Compulsory Waste of Boots." "The Telegraph in the Field." "Firing over Infantry in Action." 18th May. "Electors or Soldiers." "Panaceas." "Pay on the Active List." "Proportional Pensions." The last three interesting reading to French army specialists. 22nd May. "Military Workshops." "The Pontoneers at the Palais Bourbon." "L'Ancienne Armée." "Disarmament," comments on the "Figaro" revelations. 25th May. "Artillery Independent of Cavalry." "The Congo Convention," denouncing the action of the British Government in most violent manner. 29th May. "The Anglo-Belgian Convention," further abuse, mingled with threats. "Pontoneers and Engineers." "The Barracks and Public

Opinion" refers to the revelations alluded to in the "Spectateur," under the heading "Choses Graves," 15th May number.

Revue du Cercle Militaire. No. 18. "The Irregular Troops of the Chinese Army." "The Transport of Ladder Observatories by the Field Artillery." "Formosa and the Pescadores." No. 19. "The Compass for Military Purposes," very elementary instructions for the use of the pocket compass. "Irregular Troops in the Chinese Army"—(continued). No. 20. "The 'Hemerographe,' invented by Captain Blain," an optical instrument to facilitate sketching, not plan-making, in the field; of no practical utility. "The Sphere of Action of the Cyclist." "The Chinese Irregular Troops"—(concluded). No. 21. "The Fortifications of the St. Gothard," full and interesting details. "Study of Naval Tactics," review of Captain Sturdee's Prize Essay—favourable. "The Cossacks in the XVth Century."

Revue d'Artillerie.—May. "Expedition of 1830 and Capture of Algiers by the French—Organization and *Rôle* of the Expeditionary Artillery." "Notes on the Modifications introduced by the New Regulations for the German Field Artillery."

Revue de Cavalerie.—May. "The Employment of the German Cavalry in the last Imperial Manœuvres," an able summary of the operations with slightly adverse critique. "The Italian Cavalry"—(continued). "The Manœuvres of Cavalry at Bléré"—(conclusion), very readable and instructive. "Reinforcements and Remounts for the Cavalry of the Grand Army, 1806—1807"—(continued), historically most interesting. "The English Thoroughbred in the Army," advocates T.B. mounts for cavalry officers—read.

Militär-Wochenblatt.—Supplement. "Methods of War in East Africa;" lecture before Military Society, Berlin, 15th November, 1893, by Lieut. Maercker. A very valuable summary of German Experiences in East Africa, fairly and temperately written. "Bonaparte and Maillebois;" very interesting investigation whether Napoleon owed his conception of the 1796 campaign to the works of Maillebois. The author, Graf v. Montgelas, Lieut. Bavarian Bodyguard Regiment, decides against Pierron, who declares that he did. No. 37. "The 'Kurs' of the Soldier." Kurs here means "course" in its nautical sense. Criticism of the articles headed "Der neue Kurs" in Nos. 26, 27, and 31 of the M. W. "More about the Field Gun of the Future;" the writer advocates Longridge's wire guns, and condemns the Q.F. "Race against Time by Officers of the Russian Guard Cavalry;" course from Petersburg to Gatchina and back, 100 verst = 66½ miles; time: best, 7 hrs. 17 min.; worst: 9 hrs. 19 min.; road fairly level; weather favourable. No. 38. "The Causes of the Victories and Defeats in 1870;" review of Woide's work. "The Field Gun of the future"—(continuation). No. 39. "The History of the Royal Saxon Cadet Corps." "The Field Gun of the Future"—(conclusion); writer admits the excellence of the new French gun, which is practically a quick-firer, and somewhat modifies his adverse verdict in first letter. "Diminution of Calibres;" review of British experiences with 100-ton guns, &c. "Garrison Libraries." No. 40. "1760 and 1761;" review of the 20th volume of Frederic the Great's political correspondence. "The Report of the Federal (Swiss) Military Department for 1893;" should be read. No. 41. "1760 and 1761"—(concluded). "Mounted Orderlies for the Infantry;" read. "Penetration of the Lebel Rifle." No. 42. "Reform of the Military School of St. Cyr." No. 43. "The proposed New Regulations for Cavalry;" worth careful study. No. 44. "The proposed New Regulations for Cavalry"—(concluded). No. 45. "Switzerland's Readiness for War." "Changes in the French Infantry Regulations;" read. "Regulations, Instructions, and Exercises of the French Cavalry;" summary of changes introduced from an article in the "Revue de Cavalerie," No. 106, 1894; worth reading. No. 46. "The Duplication of the Sixth French Army Corps." "Switzerland's Readiness for War"—(concluded); should be read. "The Duel between the 'Independencia' and the yacht 'Andes,' 29th September, 1893."

Jahrbücher für die Deutsche Armee und Marine.—June, 1894. "The German Fleet and the Reichstag" v. Henk, Vice-Admiral, z. D. "Frederick William I on the Education of Young Men intended for Officers of the Army," by von Scharfenort, Captain a. D., Librarian of the Chief Cadet School, &c.—an exceedingly interesting historical paper. "The Drill-book of the British Cavalry;" favourable criticism, but the author is better acquainted with our book than with our practice. "The Reform of the Technical Arms" (von Frobenius). "The Drill Ground and Practical Field Training;" a description of how matters actually stand, and how they ought to stand, by M. B.; not to be missed. "The Bersagliere;" well worth reading. "One of Hampton's Raids." "Mounted Orderlies for Infantry; worth reading." Book Notices, &c.

Neue Militärische Blätter.—May. "Frederick the Great and his 'Jägers,'" i.e., field couriers, not rifles. "The Turkish Irregular Cavalry (Hamid)." "The War Fleet of Japan." "The History of the Two Year Service Bill." "Reminiscences of the Herzegovina Rising, 1882." "The Military Protection of the Italian Settlements in Africa." "Saumur," "Letters from Russia" worth attentive study.

Revue Militaire Suisse.—May. "The Engineers and the New Law." "The Proposed Reorganization of the Army," Colonel de la Rive. "Study of the Organization of the Swiss Engineers," by Lieut.-Colonel Perrier. "Military Ballooning."

NOTICES OF BOOKS.

The Life of John Churchill, Duke of Marlborough, to the Accession of Queen Anne.
By Field-Marshal Viscount WOLSELEY, K.P. London: Bentley and Son.
2 volumes. Price 35s.

The opening chapters, giving a full description of Marlborough's family and their circumstances, and of his birth and education, contain much information not generally accessible. In the account of the children of Sir Winston Churchill (Marlborough's father), it is stated that "Jaspar, died young," and was not one of the four sons who "lived beyond childhood." But this is not correct, for Jaspar was appointed Ensign in the Admiral's Regiment in January, 1678, and died in 1682, aged about 24. The story of Marlborough's early life, of his courtship and marriage, and of his services with the English contingent in the war with the Dutch, is clear and circumstantial, and the authorities for the statements are appended. The numerous letters and extracts quoted throw much light on the characters and conduct of the rival monarchs, James and William, and other personages; and where the author's estimate differs from that generally accepted, ample reasons are given for the opinions expressed. The name of the French King is Anglicised into "Lewis," except in part of Chapter XVI, where the more usual spelling of "Louis" is retained. Lord Wolseley, following most authorities, repeats, in three places, the statement that the Admiral's Regiment was incorporated in the Coldstream Guards in 1689. But Major Edye has shown, in the first volume of his critical "History of the Royal Marine Forces," from official documents of unimpeachable authenticity, that the Admiral's Regiment was disbanded on the 28th of February, 1689. About a month after that regiment was officially disbanded, some men who had served in it, or in the Holland Regiment (3rd Buffs), were transferred to the Coldstream; and this seems to be the only foundation for the generally accepted account of the incorporation. There are many clerical and typographical errors which should not have been passed by a careful "reader," but these, it may be presumed, will be corrected in future editions.

In several passages in both volumes there are several warnings about our unpreparedness to resist invasion, or to take part in foreign wars; grave apprehensions

lest the integrity of our mighty empire be lost, or at least imperilled by the inefficiency or insufficiency of our fleets and armies; and the folly of incurring the risk of ruinous defeat, in order to effect comparatively petty savings for political or party purposes, is urgently deprecated.

The dates being given in the margin, both in "old style" and "new style," and the division of the text into short chapters with plain headings, are very convenient, and greatly facilitate reference, but the work deserves a far more copious index than that of the present edition.

No intelligent person can peruse this work, the result of many years' reading and reflection and varied experience of war, without being struck with its candour and independence; for the author does not palter with the truth as regards his hero, whose failings and misconduct he does not seek to extenuate, though he maintains that, in a time of general lax morality and political dishonesty, Marlborough was so far above his fellows that his vices seem comparatively virtues.

To write the later part of the "Life," dealing mainly with Marlborough's successful military operations, will be more congenial work for Lord Wolseley than recording the unprincipled selfishness, the shameless profligacy, and the treacherous desertions of those who followed the example of Royalty during the reigns of Charles and James, and even of William. The appearance of the expected volumes in continuation may, therefore, be awaited in confident anticipation of large accessions to our historical and military knowledge.

The last paragraph of the second volume, characterised by candour and generosity, seems a fitting conclusion to this notice. "That he had his faults is freely admitted, and it is sometimes harder to excuse petty foibles in a great man than to forgive those huge errors which are the outcome of deep passions, and are often redeemed by pathos and tragedy. It is sorry work to dwell on the errors of the mighty dead, or on the malevolent skill which exaggerated them, and Marlborough's calmness and indifference under insult may have goaded his detractors to further attacks. But surely John Churchill's faults may be deemed as more than expiated when we remember that he, formerly so handsome, so gallant, so dominant, was, in his helpless old age, shown for money by his own servants to visitors at Blenheim Palace, an object of vulgar curiosity to sightseers in the lonely corridors of the vast pile built to commemorate his glory. Yet his fame still enriches our national history, and for generations his name lived in the terrors of our enemies as French mothers hushed their children with the national alarm of 'Malbrook s'en va-t-en Guerre.'"—O.C.

Historical Records of the 40th (now 1st Bn. South Lancashire) Regiment. By Captain R. H. RAYMOND SMYTHIES. Devonport, Swiss, 1894.

The old "Fighting Fortieth," with its varied services in all parts of the world, furnishes ample material for a regimental history. From the time of its formation in Nova Scotia, one hundred and seventy-six years ago, its record has been one of which any regiment in the world might feel proud. To follow it, even in a cursory manner, through its long and honourable career is more than the time at our disposal admits of; but some idea of the extent of its war service may be gathered from the fact that until 1881 it could boast of more honours on its colours than any other single battalion regiment in the service, the first being "Louisburg," in 1758, and the latest, "New Zealand," 1860 to 1866. For over a century and a half the regiment was content to exist without any record of its services. The late Captain F. Hibbert Nelson was the first to compile an account of his regiment's history, which he brought down to 1845 and published, privately, in India. In 1891, when the colours and other valuable testimonies to the regiment's prowess were destroyed by fire, the present compiler published in Jersey a brief record of the battalion. Upon this he has since enlarged; and, having read the present record carefully from commencement to finish, we can unhesitatingly pronounce a favourable verdict upon it. It is no mere chronicle of facts strung together, but it is a history compiled with evident care by one whose heart was in his work; and it redounds the more to Captain Smythies' credit that he has written the entire work himself. Though it is not altogether free from typographical errors, it has been

corrected for the press with care. In our opinion it is far too bulky, and more than due prominence has been given to the events of the New Zealand War, which occupy forty-seven pages, while only fifty-three are allotted to the whole Peninsular War. Not the least interesting portion of the book is the chapter containing the instructions for the duties of Light Infantry on their formation in Ireland in 1771. It will interest Captain Smythies to know that light infantry were first formed in the 40th in America on 14th May, 1758, but dissolved in 1763. All the regiments which took part in the seven years' war had light companies, but they were dissolved at the Peace of 1763, and their formation as a permanent institution dates only from the year 1770 in England and 1771 in Ireland. They maintained their position until the abolition of flank companies by General Order of 24th December, 1857.

The book is beautifully illustrated with portraits and coloured plates of the uniform at different periods, which, when it is mentioned that they were executed under the supervision of Mr. S. M. Milne, may be accepted as accurate to the smallest detail. The same gentleman, whose services have been so often called into requisition in the case of other regimental histories, has contributed the very interesting chapter on the colours and uniform of the regiment from his unique knowledge of these subjects.

It is a somewhat painful reflection that of the very large number of officers who have at one time and another served in the army so few take any pride or interest in perusing the histories of the regiments which in many cases have been their homes for the best portion of their lives; though they will wrangle over and cling with bull-dog tenacity to a mere number years after it has been officially decreed to cease. Captain Smythies is a very creditable exception, and is deserving of every praise for the history which he has compiled. But it is a satire on the literary qualities of the British officer and on the *esprit de corps* of the old officers of the 40th to have to read in the first page of the book that the number of copies printed is limited to 250. In other words, in the estimation of the compiler—who is probably the best judge—of the large number of service institutions, clubs, and officers serving, or who have served in the 1st Batt. South Lancashire Regiment, not more than 250 at the outside take sufficient interest in its glorious deeds to prompt them to wish to possess a copy of its history.

R. H.

The Naval Annual, 1894. T. A. BRASSEY. London and Portsmouth: Griffin and Co. 12s. 6d.

The eighth issue of this useful work has now appeared and will be welcomed by naval officers and others interested in naval matters both English and foreign.

The "Annual" this year is divided into five parts, the fifth being Lord Brassey's own contribution, "Our Naval Position in 1894," which appears at the end of the work instead of among the other papers in Part I, an alteration rendered necessary in consequence of the absence of the author in India. Anything from the pen of Lord Brassey on naval matters will always command attention, but we are afraid that his paper this time will be found disappointing. Part I, as usual, consists of contributions by several well-known writers, there being no less than 13 chapters, nearly half the book, devoted to the different subjects here discussed. Chapter I—the "Progress of the British Navy," a compilation (the name of the compiler not being given), is a useful addition to the "Annual," which has been wanting in previous editions. M. Weyl, the well-known editor of "Le Yacht," for the third time contributes the "Progress of Foreign Navies," which forms the contents of Chapter II, and which is extremely useful for the purpose of reference and is, in our opinion, the most valuable of the papers in the present issue. Chapters III and IV contain an interesting and useful *résumé* of the British and Foreign Manœuvres of last year, by Mr. Thursfield, who also contributes Chapter IX on the loss of the "Victoria," which, able and impartial as it is, we cannot help thinking it would have been better to have omitted, dealing as it does with a subject full of contentious points on which a striking divergence of opinion exists, while the memory of the distinguished admiral, who, if to blame, at least expiated his mistake by death, might well have

been left at peace, instead of the grim spectre of controversy being once more raised over the waters which form his grave and that of the gallant officers and men who perished with him in the service of their country. Mr. Laird Clowes, in Chapter V, gives the results of his visit to the great French arsenal and dockyard at Toulon. Chapter VI is another short paper by Lord Brassey, on the comparative strength of our own and other navies. In Chapter VII, Admiral Colomb deals in a concise and readable form with the questions of our "Strategic Position in the Mediterranean." Chapters VIII, X, XI, and XIII, by Captain Eardley Wilmot, on the "Agitation in 1893 for the Increase of the Navy," by a student of Naval History on "Moderate Dimensions," by Mr. Laird Clowes, on the "Naval Revolt in Brazil," and Professor Laughton on "Convoy," are all interesting in their way; while in Chapter XII, Commander Robinson makes a really interesting and valuable contribution to the "Annual" in his paper on "Naval Reinforcements in War Time, and our Supplementary Reserves for War-ship Building," giving as it does in a concise form from authoritative sources what we can expect in an emergency in the way of shipbuilding from the principal private ship-yards of the country. Part II contains the tables and plans of British and foreign armoured and unarmoured ships, and we may say at once there is room for a great deal of improvement here. Instead of the ships being all lumped together under the two headings of "armoured" and "unarmoured" vessels, they ought to be properly classified as is done in Durassier's "Aide-Mémoire de l'officier de Marine," and "the K. u. K. Krieg's Marine-Almanack," and we cannot conceive why this work, not a very difficult undertaking, has never been carried out; with regard to the plates of ships, as we pointed out last year, their value would be much increased if the different thicknesses of armour on belt, battery, turrets, &c., and the nature of the guns mounted in the different positions were shown, as is done in the much smaller plates given in the "Almanack," while the valuable additional information to be found in the notes attached to the table of ships in the "Almanack" might also be well copied into the "Annual."

Part III, on armour and ordnance by Captain Orde Browne is particularly interesting, giving as it does details and plates of the more important armour-plate trials in Chapter I, while Chapters II and III on ordnance and quick-firing guns will well repay the reader; the comparative tables of ordnance of different countries concludes this portion of the work, the accompanying explanatory plates are very good, and we may also observe that the illustrations of ships, always excellent, are this year particularly good, the illustration of the Italian battle-ship, "Re Umberto," being really artistic.

Part IV deals with the various naval estimates, statistics, &c., concluding with some extracts from Mr. Riley's paper on "Coal Consumption of Ships of War," and does not call for any special notice.

In spite of what we consider its defects the present issue will be heartily welcomed by naval officers, and we must give full credit to the editor and all concerned for the trouble which has been taken to bring the "Annual" out at its usual date, and which will be fully appreciated by its many readers. We may, perhaps, however, be permitted to suggest to the editor, whether the time has not come for some reorganization of the work. We are inclined to think that too much space in the "Annual" is devoted to what may be called the "Occasional Papers," and, valuable and interesting as most of these are, it must yet be remembered that they merely represent the opinions of the writers and are often of a contentious nature. We do not refer to such chapters as those on the "Progress of Our Own and Foreign Navies," or to the one on the "Naval Manœuvres and the lessons to be learnt from them," these are valuable for the purposes of reference, and rightly form a part of the "Annual," while the information as to the resources of our private yards, compiled by Commander Robinson, might well be permanently incorporated in the work, but we think that the space now allotted to the other papers would be better devoted to short essays on subjects of general interest to naval officers, and of which they know as a rule but little, as, for instance, "International Maritime Law, including the Laws of Blockade and Neutrality," "The System of Organization adopted in Foreign Navies," "The system of Coast-defence adopted in Foreign Countries" "A Concise Description of the Various Systems of Torpedoes used abroad

&c.; "A Description of the Leading Principles adopted in the Construction of Foreign Battle-ships of different types and Cruisers." Papers on such subjects, if written by experts, would form a standing portion of the "Annual," and would be invaluable for the purposes of information and reference. Other papers on general subjects, such as now form so prominent a feature in the "Annual," might still easily appear in the form of an Appendix. The navy owes a deep debt of gratitude to Lord Brassey for the public spirit which prompted him eight years ago to start the "Annual," and for the trouble since devoted to it, which has brought it to the undoubtedly high standard it has reached, and in throwing out the suggestions we have, we have done so because every naval officer is interested in the success of Lord Brassey's work and because we should like to see the "Annual" the best work of its kind in Europe, and, while it might easily be made the best, we cannot honestly say at present that we think that it is.

H. G.

1. *Reglementarische Studien* (1893). Berlin: A. Barth.
2. *Praktische Taktik und Taktische Theorie. Polemische Betrachtungen über Reglementarische Fragen* (1893). Berlin: Luckhardt.
3. *Unsere Heutige Infanterie Taktik im Spiegel der August Kämpfe, 1870 um Metz*. By W. VON SCHERFF, General der Infanterie, z.D. Berlin: Mittler, 1893.

The above three works have all grown out of the controversy initiated in Germany by the publication of the 1889 Drill Book, and as our own drill books have given rise to a similar problem, it may be of interest to contemplate the German efforts towards its solution. Briefly stated, opinions in both countries are divided as to the degree of freedom which may safely be conceded to the junior ranks in the execution of the attack. The school in favour of the extreme "normal" attack was decisively routed in Germany many years ago. Public opinion then swung over pendulum-wise, and demanded unlimited license, and the "go as you please" style.

Practically, the army adopted a middle course, and, by constant practice on the manoeuvre ground, evolved a method which fairly met the conditions—neither too rigid on the one hand, nor too lax on the other. It was simply the outcome of the mutual knowledge and confidence engendered in all ranks by the habit of "playing together," much facilitated by the general principle that each man in his respective rank was held responsible, that the bugle sound "das ganze," or "stand fast," should find each in his right position relatively to his neighbours, whether he had received orders or not.

That is to say in simpler language, by dint of "playing together" the constituent elements of the army had evolved the same source of strength and unity of purpose that characterises a good football or polo team—a gain which we in England should find no difficulty in appreciating.

But German officers have no time to play polo and football; moreover, as a race, they are in the habit of attaching more importance to the printed word and its logical consequences than to the actual fact, and, judging by this controversy, the disputants seem to have been far more occupied by the pen and ink arguments, for and against, than by the actual evolution of things.

A number of papers pleaded the cause of subaltern emancipation, with a misdirected zeal and fervour worthy of our English "wild women," and against these Scherff took up his pen, pointing out, with that rare logical precision peculiar to himself, that this freedom might be abused, and that, within reasonable limits, combined and prescribed action was still imperative. His opponents hailed him as a reactionary of the most extreme order, and others joined in the cry without taking the trouble to study his articles; and this has necessitated the two last-named of the above-mentioned works.

A few words as to the personality of the author, gathered from recent conversations in Berlin, may be of interest, for we find a complete misconception existing in the minds of most British officers on the subject. To us he is chiefly known by his first work, "The New Tactics of Infantry," which appeared about 1873, and which alone has been translated.

His style must bear the responsibility; it requires concentrated effort to study, and in the original is almost repugnant to English readers. For this he is not

altogether to blame, it is rather the custom of the country; Germans writing on subjects which require precise thinking care nothing for literary style, but everything for clearness; moreover, their whole military education is directed to teach them to think and reason, not merely to learn by heart, and as they take their profession very seriously, they are not averse to the effort of concentrated attention involved.

Judging him by his works, most of us appear to have formed a conception of the man as a pedant, with the usual accessories of spectacles, stooping shoulders, &c. Nothing could be further from the truth; from the unanimous testimony of those who have served under him, he is a practical, hard, and energetic officer, capable of inspiring absolute confidence in his subordinates. The reason is not far to seek. Men accustomed to precise and logical thinking can forecast rapidly, and with certainty, the consequences of their decisions; it is only the man who cannot foresee the consequence of his action who finds it necessary to hesitate.

Of war service the General has had his share. Besides the 1866 campaign, he was on Schwarzkoppen's Staff at the attack of the Bruville heights, on the 16th August, 1870, Mars-la-Tour, and with the division throughout the war. His presence at the slaughter of Wedell's (35th) Brigade seems to have left an abiding impression on his method of thought. The brigade, it will be remembered, engaged without artillery support, under every disadvantage of armament, numbers, and want of superior direction, and was cut to pieces as a consequence. It is not straining the probabilities too much to assume that this want of artillery preparation, and of superior direction, left their mark on his mind.

To summarize the contents of these three volumes briefly. The General points out, (1) that practically all flank attacks end locally in frontal ones; (2) that infantry, whilst not disdaining artillery assistance, must, in the last resort, be prepared to rely on themselves alone, on pain of abdicating their position as "Hauptwaffe" and becoming a mere auxiliary; (3) that strategical considerations rule higher than local tactical ones, and therefore infantry must expect to have to fight when and where they are ordered, and not when and where the ground and convenience dictates; and (4), finally, that, though as the fight progresses the cohesion of the units in each grade of command successively is destroyed, yet each leader in turn must keep in his hands the direction of his command, as a whole, until efficient superintendence ceases to be possible.

Though we recommend the study of his works most cordially, we feel it, nevertheless, necessary to add a word or two of caution. Scherff deals with tactical problems "logically," but the matter does not always lend itself to logic. The success or failure of an attack or an evolution depends on the product of a large number of variants, several of which may be of an indeterminable nature. The only way to approach the question seems to us to be by the mathematical method of limitations, and considering the consequences of variations in each factor between certain limits. It is this which constitutes the difficulty of the subject; each factor may be simple enough as a whole, but it is their number, and the impossibility of assigning relative numerical values to each of them, which constitute in the aggregate a difficulty which hitherto none but the greatest geniuses have succeeded in overcoming.

F. N. M.

— *A Manual of Saddles and Collars, Sore Backs and Sore Shoulders.* By Veterinary Captain F. SMITH, A.V.D. 2nd Edition. London: Harrison and Sons, 1894. Price 1s.

The second edition of this excellent little work, revised and corrected up to the date of publication, 5th May, 1894, is now before us, and every officer who has to deal with horses, whether in draught or under the saddle, will, we believe, join with us in thanking the author for the care and pains he has bestowed on its production. Still there is one chapter omitted, which we hope will hereafter be supplied, viz., the bearing of condition and stable management on the production of sore backs and collar galls. This factor seems to us to exercise far more effect on the question than the *form* of the saddle, within the same limitations as regards fitting. We have seen horses in hard condition marching under all kinds of saddles without injury; and, again, other horses in soft condition becoming injured

in a quarter of the distance that the others stood without wincing. In the German Manœuvres of 1892, the work done by the cavalry was almost incredible; for the four days the great strain lasted horses were rarely unsaddled, and were marching from 40 to 60 miles a day for the squadrons, with up to 100 miles for the patrols. Three kinds of saddles were in use, the Hungarian, the Danish or cuirassier pattern, resembling our own, and the new army saddle, which seemed to embody most of the defects of all the others; yet, though we inspected over 1,500 horses under conditions which rendered concealment impossible, we saw not one single case of sore back in the whole. Now, saddlery inspection is not more thoroughly done in the German Army than in our own; therefore, if our own experiences in the Berkshire Manœuvres were less favourable, some other factor than the saddle or its fitting must be the explanation, and we can only regret that the author has not elucidated it.

Of course he frequently refers to the importance of "condition," but what the book wants to render it complete is a definition of this "condition," and the best method to attain it, for on no other point is there more divergence of opinion, or a more widely disseminated mass of mis-information. F. N. M.

The Great Alternative: A Plea for a National Policy. By SPENCER WILKINSON. London: Swan Sonnenschein, 1894. Price 7s. 6d.

Mr. Spencer Wilkinson is already well known to readers of this Journal as one of the few civilians who has, with a single-mindedness only too rare nowadays, endeavoured to master, and has indeed successfully grasped, the principles on which the security and welfare of our Empire essentially depend. In this work he has gone beyond all his previous efforts, and has succeeded in formulating distinct propositions in language which even the man in the street cannot fail to understand. His subject trenches too closely on the political field for discussion here; we can only most sincerely recommend the book, but—with the following reservations: The initiative has now passed out of our hands, the spell of our power is broken, the issues of peace or war now rest in the hands of misinformed voters, instructed by a still more misinformed press. It is no longer a case of how strong we actually are, but how weak we appear to be, and the only way, short of war, by which we can re-establish our prestige is by the creation and maintenance of a fleet at sea capable of convincing our possible opponents of its supreme power. A war, even if successful, would cost the country not much less than 500 millions; the necessary preparations to avert war not one-tenth of that sum, and there may yet be time to choose. The final chapter on the "Revival of Duty" should be read by everyone, and Mr. Benjamin Kidd's work on Social Evolution, already reviewed in these columns, may be profitably studied in connection with it.

F. N. M.

1815. Par HENRI HOUSSAYE. Paris: Perrin et Cie. Price 7s.

This work is already in its fourteenth edition, but has not yet succeeded in attracting the attention it deserves in this country. Though it ceases with the departure of Napoleon for the frontier previous to Ligny and Waterloo, it affords material of the highest importance for the correct appreciation of the problem solved on those battle-fields. Military historians too often ignore the fact that an army is only the embodiment of the strength and weakness of the nation from which it springs, reflecting minutely the loyalty, sense of duty, courage, or their opposites, of the molecules which go to its composition. No man can cut steel with a leaden chopper, and no skill on the part of a leader can compensate for want of temper in the weapon—i.e., the army that he wields—and since the army reflects the qualities of the nation from which it springs, these qualities and their surrounding conditions must be accurately weighed and sifted before tenable conclusions as to the skill or weakness of the leader can be formulated. Napoleon's campaigns, viewed merely as chess-board problems, are a barren study, but, read in the light shed on them by works such as this of M. Henri Houssaye and the better known ones of M. Taine, they become a study for all time worthy of the highest intellects.

F. N. M.

- *Offizier Felddienst Uebungen.* By Lieutenant-Colonel LITZMANN. Leipzig: George Lang, 1893. Price 2s. 6d.

This little book should prove of special service to regimental officers called on to arrange minor tactical operations for their junior ranks. These exercises lose half their value unless based on some simple general idea which commends itself to the common sense of the executants, and how difficult it is to find one those know best who have had to try it oftenest. Again, the task of umpiring and criticising these small encounters is far from easy, and the best way to fit one's self for the task is by the study of examples of this description. The method throughout is that of von Verdy, only applied to smaller forces, and another excellent example may be found by the would-be student in von Arnim's "Diary of a Company Officer," translated in this Journal in 1875. F. N. M.

- Tactics as Applied to Schemes.* By Captain J. SHERSTON, R.B. Aldershot: Gale and Polden. Price 2s. 6d.

Captain Sherston's own preface describes the book, its scope, and contents best. "These notes are written in order to assist officers in applying the principles contained in the drill books to the solving of tactical schemes as set in the examinations for promotion. The matter contained in them is taken from the text-books and other official sources."

- *Mountain Warfare as Applied to India.* By Captain F. C. CARTER, Northumberland Fusiliers, D.A.A.G., Allahabad Dist. Simla, 1893.

This pamphlet forms No. 110 of Vol. XXII of the Journal of the United Service Institution of India, and is the essay placed first by the referees for the Gold Medal of that Institution last year, but disqualified for the Medal because the limit of space laid down was exceeded.

It appears that Captain Carter, being in England at the time the Council of the Institution decided to alter the form and type of the Journal, was unaware of the change, and as he had calculated his space from copies of previous Gold Medal Essays, and therefore was not to blame, the decision to disqualify him must be regarded as a very hard measure.

Seeing the importance mountain warfare has acquired in the British Army, wide publicity should be given to this little work, for it not only contains a mass of well-digested information and valuable hints on all points of detail, but forms also a reference index to all works of value bearing on the subject. As Captain Carter has had considerable practical experience in hill campaigning in Afghanistan, the Black Mountain, and the Chin Lushai Expedition, his work may be recommended with some degree of confidence. F. N. M.

- *Man-hunting in the Desert: Being a Narrative of the Palmer Search Expedition, 1882-83.* By A. C. HAYNES, Captain R.E. London: Horace Cox. Price 2s.

An exceedingly interesting and attractive history of the long-protracted hunt after the murderers of Captain Gill, R.E., Lieutenant Charrington, R.N., and Professor Palmer. Few events at the time made a greater impression on intelligent Continental opinion than the relentless perseverance with which the culprits were tracked and eventually brought to justice, and as a study of the conflict between Oriental intrigue and British determination it is invaluable. The country traversed is but little known, and as a work of reference, should future events again lead us there, the book will be invaluable, whilst to all who may be called on for similar secret service work the example of conspicuous courage and resolution given us by Sir Charles Warren should prove of the greatest service. F. N. M.

- *Climbing in the Karakoram-Himalayas.* By W. M. CONWAY. With 300 illustrations by A. D. McCormick. London: Fisher Unwin. Price

Mountaineering now forms, or, to be more precise, should form, so important a part of the stock-in-trade of the British officer, that we make no apology for noticing this book at considerable length.

Its literary and artistic excellencies have been done sufficient justice to by abler pens in the contemporary press, yet as one to whom the glories of Himalaya are not entirely unknown, we cannot withhold our tribute to the perfection and accuracy of Mr. Conway's work. To the best of our knowledge, no other writer has ever yet succeeded in conveying, in a few short, nervous sentences, so vivid a picture of the glories of light and colour he wishes the reader to realise. This is "word painting" in its highest form, and we shall ever be grateful to him for the rich feast of colour banquets with which he has provided us.

To the geologist, the book should be invaluable. Mr. Conway has brought trained faculties to his work and uses his words with full sense of their precise meaning—as a contribution to our knowledge of the architecture of mountains, sub-aërial denudation, glacial action, formation of lake beds, &c., it is indeed invaluable.

To the soldier and explorer, the difficulties to be overcome and his method of tackling them will be the most instructive portion. Sun, hunger, thirst, rarefied air, and ice seem to have been the worst of these; of the latter we know relatively nothing, and further information would have been welcome; on the first and intermediate terms of the series we venture to offer a few suggestions. The human body can be efficiently protected against the effects of the direct rays of the sun by adopting the same method which the photographer employs to preserve his sensitive plates, viz., by an envelope of orange or ruby colour, which envelope need not be worn outside. Against the disturbance created by the rarefaction of the air, the course of breathing drill described in Surgeon-Captain Hoper Dixon's paper in this number of the journal will be found to give relief. Mr. Conway and other mountaineers seem fully acquainted with the fact, but as yet they do not appear to have systematized their practice with the same precision. Hunger and thirst are best overcome by use of the kola nut. Mr. Conway used some kola biscuits, and it is interesting to note what he says of them, see p. 457. "We were again experimenting on the kola biscuits (a biscuit prepared by a Marseilles firm). Before starting, we each drank a quart of soup made of meat peptone, and ate a few Garibaldi biscuits. On the mountain we ate nothing but kola biscuits, one for each man per hour, and a little chocolate. We drank only water or snow, but we had a small pocket flask of liqueur brandy with us—for use in case of an emergency, which was always invented sooner or later. On this light food we climbed the whole day without suffering the least discomfort or feeling the slightest pangs of hunger or exhaustion; when we returned to camp in the evening, we ate a small supper, slept well, and awoke next morning perfectly refreshed. Then it was that hunger came upon us, and we made up at every meal for the drain upon our reserve stock of energy which I suppose the kola had enabled us to effect." As no details are given as to the size of the kola biscuits, it is impossible to say how much kola was actually consumed. From our own experience we should say that a couple of ounces of the nut would have sufficed to meet the drain on one's reserve for a couple of days, even allowing for the elevation (18,000 to 20,000 ft.), nor can we understand any unusual hunger ensuing on one day's use of the nut, for, after living almost exclusively on kola for days together, the only apparent result was the development of a craving for butter and fat.

Finally, we have one fault to find with the book. Now and again in its pages we are too forcibly reminded of Mark Twain's ascent of the Riffelberg and Harris's report on the Furka Glacier.

F. N. M.

Mémoires pour servir à l'Histoire de Napoléon I, depuis 1802 jusqu'à 1815. Par le Baron CLAUDE FRANÇOIS DE MÉNEVAL, Secrétaire du Portefeuille de Napoléon, &c. Né à Paris, 1778; mort dans cette ville, 1850. Published by le Baron Méneval. 1st volume. 3rd Edition. Paris: Dentu, Place la Valois 3, 1894. Price 12s.

The chief value of this most readable work lies in the light shed on Bourrienne's relations with Napoleon, enabling us to discount the value of the former's testimony. De Méneval relieved Bourrienne as confidential secretary to Napoleon in 1802, and narrates the scene explaining the cause, viz., abuse of his position of confidence in securing contracts for his friends. In 1825 De Méneval met Bour-

rienne, who assured him that he had no intention of revenging himself on a dead man by revealing secret history; but subsequently Bourrienne, having drifted to Hamburg in very bad circumstances, did give his name to a firm of Paris publishers. Still De Méneval does not believe that at the time he was physically in condition to perpetrate the work known by his name, as he was then suffering from the disease that caused his death two years later in an asylum at Caen. At most he probably only supplied disconnected notes, which his editors supplemented by independent research.

The pages in which the question of the invasion of England is treated deserve careful study. De Méneval asserts most positively that the First Consul was in earnest, but he writes without any grip of "sea power," and his accounts of the state of preparation attained to should be compared with De Fezensac's memories with regard to life in the camp at Boulogne.

F. N. M.

La Captivité de Sainte-Hélène, d'après les Rapports inédits du Marquis de Montchenu, Commissaire du Gouvernement du Roi Louis XVIII dans l'île. Par GEORGES FIRMIN-DIDOT, Secrétaire d'Ambassadeur. Paris: Firmin-Didot et Cie., 1894. Price 7s. 6d.

From a Royalist one expected a fairer statement of the case than the Marquis de Montchenu provides us with. The patriotic bias evidently obtained the upper hand in his mind, for we are treated to a fresh series of diatribes against the British Government and Sir Hudson Lowe, together with an apotheosis of Napoleon. Granted that the former was not distinguished by his tact as gaoler, common sense men must admit that Napoleon was scarcely faultless as a prisoner, and in any case surely the time has come to bury the hatchet. French patriots might at least remember that it was the British Commander who saved their idol from summary execution with the rope, and protected their capital from outrage. Students of O'Meara, Las Cases, and Monthonlon will find little new in these pages, and what is new is of questionable veracity.

F. N. M.

Studies in Applied Tactics. Part II. Lieutenant VON DONAT. London: Stanford. Price 3s.

A second series of the studies already reviewed, and of equal excellence.

Railway Policy in India. By HORACE BELL, C.E. London: Rivington, 1894. Price 16s.

This book contains only Mr. Bell's personal ideas, but many of the data are from official returns, and the whole work will repay most careful study on the part of staff officers.

British Dominion in India. LYALL. London: John Murray. Price 12s.

Gesichtspunkte und Beispiele für die Abhaltung von taktischen Uebungsritten. Major VON MÜNZENMAIER. Berlin: Mittler. 1894.

Taktische Uebungen am Fusse der Vogesen. VON HAUPTMANN VISCHER. Berlin: Mittler. 1894.

Very highly spoken of by the Austrian "*Organ Des Militär-Wissenschaftlichen Vereins.*"

Leitfaden für den Unterricht im Festungskriege, for the Austrian educational establishments, by von Brunner, the well-known Austrian engineer and authority on questions of defence. Vienna: Seidel and Sons. 1893.

Modern American Pistols and Revolvers. By A. C. GOULD. Illustrated. Boston, Mass.: Bradlee Whidden, 18, Arch Street, 1894. Price 6s.

Well received both in the American military magazines and in Arms and Explosives.

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